CSI-Thermal Program
Energy Division Staff Proposal for Solar Water Heating Program

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1. Executive Summary

Solar Water Heating (SWH) has been employed in California for more than a century, enjoying varying degrees of popularity over that time. As a result of the energy crisis and the environmental awakening of the 1970s, the state made its first attempt to promote widespread use of the technology in the early 1980s. Although this effort was successful in deploying thousands of SWH systems statewide, the programs were eventually abandoned, doomed in part by a lack of strict quality control and the return of inexpensive fossil fuels.

Today, there is renewed interest in the technology. The need to address global warming, reduce dependence on imported fossil fuels, dampen volatile energy prices and create new green jobs have renewed the focus on SWH as a potential means to help solve our diverse problems. Meanwhile, improvements in technology and the advent of independent rating agencies ensure system owners that SWH systems will be of high quality. Californians feel the time is ripe for a new focus on promoting SWH.

1.1 Opportunity for a New Solar Water Heating Program

The California Legislature and the California Public Utilities Commission (CPUC) have already taken steps to create incentive programs aimed at increasing use of SWH among homeowners and businesses. Assembly Bill (AB) 1470 authorizes the creation of a $250 million incentive program to fund 200,000 SWH systems that displace the use of natural gas by 2017. In addition, the California Solar Initiative (CSI) includes a $100.8 million fund for non-photovoltaic technologies that displace electricity, and the CPUC has stated its intent to allow SWH to qualify for those incentives.

Before SWH systems can qualify for either incentive program, however, the Commission is required to assess the results of the Solar Water Heating Pilot Program (SWHPP) – currently underway in the San Diego area – and to make certain findings with respect to cost-effectiveness. This Staff Proposal will present separate analyses of those two system types.

In the case of SWH systems that displace natural gas, Energy Division must determine whether or not the 8-year incentive program envisioned by AB 1470 is cost effective for ratepayers and in the public interest, and if so, to design and implement such a program. To answer the cost-effectiveness questions raised by AB 1470, the analysis we present here looks at the costs and benefits of an 8-year, $250 million incentive program for natural-gas displacing SWH. Our analysis will consider various future scenarios with different market conditions, and it will consider the potential effects of market transformation on cost-effectiveness.

In the case of incentives for SWH systems that displace electricity, Energy Division considers whether or not the systems are currently cost-effective without incentives. Since electricity is a more expensive way to heat water than natural gas, the Commission may be concerned that electric-displacing systems are already cost-effective for system owners, which could result in installers or manufacturers capturing the benefit of the

incentives in the form of higher prices. Thus, Energy Division carefully considers the cost-effectiveness of installing electric-displacing SWH systems from the perspective of the system owner under present market conditions.

In addition, Energy Division proposes applying the same cost-effectiveness standard to the question of incentives for electric-displacing SWH systems that we apply to natural gas-displacing systems: Would an 8-year incentive program be cost effective for ratepayers and in the public interest?

Energy Division thus recommends that the Commission provide incentives to electric-displacing SWH systems if doing so would be cost-effective for ratepayers and in the public interest, but the technology itself is not yet cost-effective for those employing it in the absence of incentives. This approach is consistent with the principle that government should fund technologies that provide public value, but for which there are not sufficient private benefits to foster adoption by the private sector.

Our analysis of the system types will thus differ in that, in addition to being cost-effective from the public interest perspective, electric-displacing systems must be less than cost-effective from the participant perspective in the absence of incentives.

1.2 Energy Division Findings

Our analysis finds that a $250 million SWH incentive program for systems that displace natural gas can be cost-effective for ratepayers and in the public interest. We find that even under the most conservative future scenario, a SWH incentive program can have a benefit-cost ratio of greater than one for both program participants and society, given reasonable assumptions about changes in the SWH market.

Based upon this finding, Energy Division proposes that the Commission move forward in designing and implementing the $250 million SWH incentive program authorized by AB 1470. This program should seek to promote widespread adoption of SWH through monetary incentives, marketing and outreach, training and technical assistance. Energy Division will describe its recommendation for the structure of this program in this Staff Proposal.

This Staff Proposal also finds that a program to fund electric-displacing SWH systems would pass a public-interest test for cost-effectiveness. In addition, Energy Division finds that SWH systems that displace electricity are not currently cost-effective for system owners. For this reason, Energy Division finds that it is desirable and appropriate to allow SWH to qualify for incentives under the $100.8 million CSI non-PV electric-displacing fund.

In order to increase program efficiency and eliminate duplication, Energy Division recommends that both of these new SWH incentive programs be managed by a single administrative structure. This new program, which we will hereafter refer to as the CSI—Thermal Program, will administer the incentives and track progress for both natural gas-displacing and electric-displacing SWH systems, even though the funding sources will be different for each component of the program.

1.3 SWH Interim Evaluation and Market Assessment

This staff proposal bases its conclusions largely on the work of Itron, Inc., the evaluation contractor hired to assess the SWHPP under the administration of the California Center for Sustainable Energy (CCSE). In its *SWHPP Interim Evaluation Report* (January 2009), Itron analyzes the progress of the SWHPP and introduces a cost-benefit methodology. In the *Addendum* (April 2009) to the interim evaluation, Itron presents the results of a cost-effectiveness evaluation based on that methodology.

In addition to cost-effectiveness analysis, Itron's *Interim Evaluation* also assesses the progress of the SWHPP and the current state of the SWH market. The *Interim Evaluation* found that participation in the SWHPP has lagged behind expectations. Although the incentive budget was designed to accommodate 750 participants over 18 months, less than 180 projects had filed applications in that time. The *Interim Evaluation* identified high upfront capital cost, lack of knowledge of SWH, permitting costs and requirements, and the lack of a well-developed SWH workforce as reasons for the lower-than expected participation. Lowering these barriers should be incorporated into the goals of any statewide incentive SWH incentive program.

The *Interim Evaluation* also identified areas of potential growth for the California SWH market. The report found that although single-family homeowners are the largest single user of natural gas water heating in California, this sector has less favorable economics than the multifamily and commercial sectors. The report found that the multifamily sector is a significant potential growth opportunity, offering the benefit of scale economies, a good match between energy source (sun) and hot water demand, and prevalence of central boilers that can be offset by SWH systems. Due to favorable economics, the commercial sector – in particular the lodging, health and restaurant sectors – offers the greatest potential for SWH market growth.

1.4 Recommendations for Program Design

The Energy Division staff proposal herein makes recommendations on the design of a CSI-Thermal Program, including program design principles, technology eligibility, program budget, goals, program administrative structure, incentives budget, incentives calculation, a low-income program, the Program Handbook process, a market facilitation program, and a measurement and evaluation program. Energy Division makes these recommendations with the acknowledgement that parties may have alternative suggestions for how to proceed with the program, and it will be beneficial to consider these alternatives as we move toward final program design. For this reason, this Staff Proposal includes an appendix with questions for parties in order to solicit input on specific topics, but the inclusion of these questions does not preclude parties from commenting on other areas of the Staff Proposal.

The recommendations of the staff proposal are as follows:

Program Goals and Strategy

- *The CSI-Thermal Program should adopt a set of goals for number of installations, reductions in SWH technology costs, and reductions to other market barriers.*

- *The CSI-Thermal Program should adopt a Program Strategy that addresses upfront costs via incentives and other market barriers via Market Facilitation.*

- *The CSI-Thermal Program should set its goals in terms of energy displaced instead of total number of SWH systems installed.*

- *The CSI-Thermal Program should be based on program design principles that build upon the CSI Program, focus on rewarding high performing systems, and grow the size of the SWH market.*

- *The Commission should adopt a goal of displacing 150 MW of electric capacity for the electric-displacing component of the CSI-Thermal Program.*

- *The Commission should adopt a goal of displacing 585,000,000 therms of natural gas for that component of the CSI-Thermal Program.*

Technology Eligibility and Requirements

- *In order to prevent a "dead period" in the SWH industry, SWH systems installed after the release of this staff proposal should be eligible for incentives under the requirements and incentive levels of the program as it is approved in its final form.*

- *The CSI-Thermal Program should provide incentives to SWH and other (non-SWH) solar thermal technologies, except for pool heating, in all new and existing facilities for customers of the investor-owned utilities. Incentives should not be offered in situations where SWH is employed to meet minimum state energy efficiency standards.*

- *All non-residential SWH systems should be required to include monitoring equipment and make performance data available to evaluation contractors for at least five years. Metering equipment should be installed on a representative sample of residential systems to verify expected performance.*

- *The CSI-Thermal Program should require appropriate energy efficiency improvements in the new or existing home or commercial structure where the solar hot water system is installed. Specific energy efficiency requirements should be specified in the CSI-Thermal Program handbook.*

Program Administration and Budget

- *The CSI-Thermal Program should be administered by the same Program Administrators as the CSI Program, with the addition of Southern California Gas (SCG) for the natural gas displacing program in its territory. The Program Administrators should have budget flexibility within the administrative expenses. The Program Administrators should submit an initial prospective budget for Commission review and semi-annual expense reports twice per year.*

- *The Commission should adopt a set of Program Administrator Responsibilities, as detailed in this staff proposal.*

- *The Natural Gas portion of the CSI-Thermal Program should adopt a $250 million budget, divided as follows: 80% for Incentives, 10% Market Facilitation, and 10% for Administration and Measurement & Evaluation.*

- *The Electric Displacing portion of the CSI-Thermal Program should adopt a budget of $118,300,000, excluding administrative costs. The non-administrative costs will be divided as follows: 85% for Incentives, 10% Market Facilitation, and 5% for Measurement & Evaluation.*

- *The CSI-Thermal Program should have an overall budget of approximately $375.5 million. The Market Facilitation and Evaluation budgets should use comingled funds from the natural gas displacing and electric displacing funds, the funding should be on a ratio of 2:1.*

- *Rate collections from natural gas customers for the CSI-Thermal Program should be allocated as follows: 51% - SCG, 39% - PG&E, and 10% to SDG&E. The rate collections should occur in even increments over eight years. Rate collections for electric customers should occur in accordance with existing CSI program decisions.*

- *CSI-Thermal Program incentives for natural gas-displacing systems should be allocated between the various customer classes in the following proportion: 40% residential (10% single family and 30% multifamily) and 60% commercial. The initial incentive split between customer classes may be revisited as the program progresses and the market response becomes clear.*

- *The budget for electric-displacing systems will not be specifically designated for Residential vs. Multifamily/Commercial. Instead, there will be a cap of 80% on program participation from the multifamily and commercial sectors.*

CSI-Thermal Program Incentives

- *Incentives for both the natural gas and electric-displacing portions of the program should be based on system performance, with actual incentive amounts proportional to expected first-year annual energy displacement.*

- *Incentive levels for SWH systems that displace natural gas should decline in four steps (per customer class, per utility territory) as the SWH market grows.*

- *Incentives for natural gas-displacing systems should start at $12.82/therm (based on SRCC first-year displacement rating) and decline in four steps to $5.13/therm. This formula will create an incentive of roughly $1,500 for the average single-family SWH system in first step and $600 in the last step. The various customer classes will use the same per-therm incentive levels, even though each class will decline independently of the others based on customer participation in each level.*

- *The Commission should adopt an incentive level cap at 125% of the average system incentive for residential systems. Incentives for multi-family and commercial systems should be capped at $150,000 for natural gas-displacing systems and $100,000 for electric-displacing systems.*

- *Incentive declines should be triggered by the annual therm displacement of confirmed reservations for each customer class, in each service territory. Incentive levels should be apportioned such that the program can provide incentives for the*

"equivalent of 200,000" residential systems, although the actual number will be a smaller number of systems, since commercial and multifamily systems displace more therms per system.

- *Incentives for electric-displacing systems should be available at one incentive level, $0.37 per first-year kWh displacement. For the average residential system, this incentive would be approximately $1,000 per system. The incentives for electric displacing systems are fixed and will not step down. The Commission should reconsider the incentive level after two years and consider reducing the incentive if the market is growing or prices are declining.*

- *The CSI-Thermal Program should use the methodology described herein to estimate the electricity displacement associated with SWH systems and use that kW capacity value to count the systems towards the CSI steps in Trigger Tracker (and the CSI electricity related program goals).*

- *The CSI-Thermal Program Administrators should develop an on-line incentive calculation tool to estimate energy displacement for electric- and natural gas-displacing SWH systems based upon expected performance of SWH system, location and system design.*

- *To calculate the incentive for single-family SWH systems (those with SRCC rating OG-300), Energy Division recommends using the SRCC estimation of annual energy savings combined with the Solar Orientation Factor, which is calculated by measuring the tilt and azimuth of the SWH installation.*

- *Energy Division recommends establishing the incentive for commercial and multi-family SWH systems (those with SRCC rating OG-100) by using currently available tools for estimating annual savings for each custom designed system.*

- *The CSI-Thermal Program Budget should set aside $20 million to fund qualified low-income single-family homeowners that install gas displacing SWH systems. The incentive level for the low-income portion of the CSI-Thermal program will be 200% of the currently applicable incentive level.*

- *The low-income portion of the CSI-Thermal Program should have participant eligibility requirements analogous to the Single-family Affordable Solar Homes component of the California Solar Initiative.*

Program Handbook, Market Facilitation, Measurement and Evaluation

- *The CSI-Thermal Program Administrators should use a public process to develop a CSI-Thermal Program Handbook. The Handbook should be submitted to the Commission via a motion to be accepted by ALJ Ruling. Subsequently, the Program Administrators should host quarterly meetings with stakeholders to entertain program modification suggestions. The Program Administrators will submit Program Handbook modifications to the Energy Division via Advice Letter.*

- *The CSI-Thermal Program Handbook should be reconciled with the current CSI Program Handbook.*

- *All incentive program requirements – including the application process, minimum equipment eligibility standards, incentive calculation, program administration rules,*

and energy efficiency requirements shall be specified in the CSI-Thermal Program Handbook. The minimum eligibility requirements included in AB 1470 should be used as a starting point for the CSI-Thermal Program Handbook.

- *The CSI-Thermal Program Administrators should be responsible for design and implementation of a set of Market Facilitation activities that address the leading non-financial barriers to the SWH market. The Program Administrators should submit Annual Market Facilitation Plans, with budgets, on an annual basis on October 1st.*

- *The CSI-Thermal program should allocate up to $15 million to Measurement and Evaluation (M&E) in order to assess the program and make recommendations for its improvement. The M&E program should be based on a plan that will be detailed by the Energy Division at a later date, but the general scope of which is included herein. The CSI-Thermal Program Administrators should be responsible for maintaining a database and conducting some public reporting.*

2. Regulatory and Solar Water Heating Pilot Program Background

2.1 What is Solar Water Heating?

Solar water heaters (SWH) use radiant heat from the sun to heat either water or a heat-transfer fluid in a roof mounted collector. The heated water or heat transfer fluid is then transferred to a water storage tank where it is ready for use (in systems where water is directly heated) or passes through a heat exchanger that heats the water in the storage tank. SWH systems typically provide 60% of the hot water needed by an end-user, with the rest provided by a back-up water heater powered by natural gas or electricity. The most common applications for SWH systems are for direct hot water uses in the home (showers, dish washers, and clothes washing machines) and in commercial businesses like restaurants, health clubs, hospitals and hotels than have significant hot water loads. A more detailed overview of the technology, including a description of the various types of SWH systems, is provided in Appendix A of this Staff Proposal.

2.2 History of California Solar Water Heating Incentive Programs

California created the first of its solar water heating (SWH) rebate programs in 1980 (Order Instituting Rulemaking (OII) 42 – Demonstration Solar Financing Program). The OII-42 Program required each of the four investor owned utilities (IOUs) -- Pacific Gas and Electric, Southern California Edison, Southern California Gas and San Diego Gas and Electric -- to propose programs that would demonstrate the role that utility-assisted financing could play towards making solar water heating a reliable and reasonably priced energy resource for the California utility ratepayer. OII 42 required that the IOU programs address the principal barriers to more rapid deployment of SWH:

- High initial costs
- Lack of consumer confidence

- Inadequate product information

To this end, the OII-42 Program paid $20 per month for 36 months to electric customers and $20 per month for 48 months to natural gas customers to help defray SWH system costs. The Program also provided a small number of 20-year 6% loans and an incentive of $8 per month/unit for 36 months for multi-family residential units adopting SWH[1[1]]. These rebate programs ran through from 1980 to 1983 and supported the deployment of hundreds of thousands of SWH systems in California. When the federal and state tax credits and IOU incentive programs ended, demand for new SWH systems crashed and many SWH companies went out of business. Though many SWH systems installed during this time continue to work, a small sub-set of them failed or experienced other problems, largely due to a lack of industry standards for quality control and third-party verification. As a result, there is a lingering perception that SWH is not a reliable clean energy technology.

California's earlier policy experience with SWH provides knowledge we can build upon in crafting a new program. One of the most important lessons is that third-party testing and equipment certification is a necessary to create a sustainable industry. This lesson has been applied to subsequent programs, notably CSI Program, which requires third party testing and equipment certification for solar PV technology. Since the time of California's earlier SWH programs, the Solar Rating and Certification Corporation[2[2]] (SRCC) has filled the void in third-party certification and become the nationally recognized standard for rating and certifying SWH equipment. When the federal tax credits were reauthorized, the new tax credit required SRCC listing of SWH equipment. Thousands of SWH systems have been installed throughout the United States (mostly in Hawaii) since the passage of the tax credit. These newer installations have been independently evaluated and shown to perform reliably with minimal maintenance.

2.3 SWH and the California Solar Initiative Background

Commission Decision (D.) 06-01-024, established the California Solar Initiative (CSI) to fund incentives for qualifying solar energy systems. As part of that order, the Commission stated its intent to include SWH in the CSI Program. Noting the mixed results from prior SWH incentive programs, in which incentives often increased the cost of the technology[3], D.06-01-024 allowed a SWHPP to test incentives for solar water heaters in the current market environment. The Commission directed San Diego Gas & Electric Co. (SDG&E) to offer a contract to the California Center for Sustainable Energy (CCSE) to administer an eighteen month SWHPP for solar water heater incentives offered to residential, commercial and industrial customers in SDG&E's territory, with rebate levels based on thermal output[4].

[1[1]] CPUC Utilities Division, Energy Conservation Branch, OIR 42, Demonstration Solar Financing Program: Summary of Activity 1980-1983 (May 1984)

[2[2]] The SRCC is an independent, third party testing center associated with the Florida Solar Energy Center that tests and certifies solar thermal collectors.

[3] D.06-01-024, page 12

[4] D.06-01-024, pp13-14 and Conclusion of Law 4

As part of the SWHPP, the Commission specified a plan for evaluating the market impacts of the program, including comparison of solar water heater prices in regions with and without incentives. The Commission required an evaluation of impacts of the pilot on equipment prices, demand, and overall cost-effectiveness.

In D.06-12-033, the Commission modified the CSI Program to conform to Senate Bill (SB) 1 (Levine, 2006). A critical change to the CSI Program following passage of SB 1 was the explicit exclusion of gas ratepayers from funding for the CSI Program. Since only electric ratepayers would be funding the new program, the Commission, in D.06-12-033, adopted the principle that only electric displacing technologies would receive CSI funding. The Commission granted an exception, however, for the solar water heating pilot in SDG&E territory, and limited the pilot's funding to $3 million.

2.4 SWH and AB 1470 Background

In light of the omission of SWH from the CSI Program, on January 1, 2008, the California Legislature passed AB 1470[5], declaring the intent of the Legislature to build a mainstream market for SWH systems. The bill gives the Commission authority to establish a $250 million, ten year statewide program to promote installation of solar water heating systems, if certain findings following evaluation of the SWHPP are made. The bill adds Pub. Util. Code § 28634 which states, in pertinent part:

> *(a) The Commission shall evaluate the data from the Solar Water Heating Pilot Project conducted by [CCSE]. If, after a public hearing, the commission determines that a solar water heating program is cost effective for ratepayers and in the public interest, the commission shall do all of the following:*
>
> *(1) Design and implement a program applicable to the service territories of a gas corporation, to achieve the goal of the Legislature to promote the installation of 200,000 solar water heating systems in homes and businesses throughout the state by 2017.*
>
> *(2) The program shall be administered by gas corporations or third-party administrators, as determined by the commission, and subject to the supervision of the commission.*
>
> *(3) The commission shall coordinate the program with the Energy Commission's New Solar Homes Partnership to achieve the goal of building zero-energy homes.* (Public Utilities Code, Section 2863)

2.5 SWH and Energy Efficiency

Solar Water Heating is currently eligible to receive incentives under utility Energy Efficiency (EE) programs, but the unique cost-effectiveness requirements for SWH have

[5] Chapter 536, Statutes of 2007 (also known as the "Solar Water Heating and Efficiency Act of 2007)

so far prevented the utilities from including SWH in their EE portfolios. Most energy efficiency measures employed in the utility EE programs need only pass a cost-effectiveness test when considered as part of the utility's larger portfolio of EE measures. The California Energy Efficiency Policy Manual, however, mandates that SWH installations be cost-effective on a stand-alone basis6. Because neither SWH technology nor incentives are cost-effective under current conditions, SWH retrofits have not been able to pass the test required to receive incentives under utility EE programs. Analysis on the cost-effectiveness of SWH will be presented later in this report.

The electric and gas utilities recently filed their 2009-2011 Energy Efficiency Program Implementation Plans (PIPs).[7] In their PIPs, the utilities propose providing incentives for solar pool heating and for SWH in new homes. The pool heating incentive does not overlap with this staff proposal. If approved the SWH incentive in new homes would have an overlap with this staff proposal; however, staff believes that the incentive for SWH in the new homes program is quite small—and that it would be appropriate to provide it to strongly encourage market adoption of SWH in new homes. Achieving high market penetration of SWH in new homes is a worthy goal of the program.

2.6 Zero Net Energy Homes

In D.07-10-032 and D.07-12-051, the Commission adopted four specific programmatic goals, known as the "Big Bold Energy Efficiency Strategies", which provide renewed focus on increasing in the size of the solar hot water market in California. The Big Bold strategies include the goal (mandate?) that all new residential construction will be zero net energy by 2020, and that all new commercial construction will be zero net energy by 2030. In order to meet those goals, it is critical that the Commission design and implement a program targeted at SWH because the technology provides a critical opportunity to reduce both electric and gas consumption associated with water heating in buildings. Unless the SWH market grows and the technology penetration level increases, the state will not be able to meet its zero net energy goals.

2.7 CSI Solar Water Heating Pilot Program (SWHPP) Background

2.7.1 Design and Implementation of SWHPP

In February 2007, the Commission issued a ruling[8] approving SWHPP, with a budget of $2,590,730, to be administered by CCSE. Among other things, the Ruling directed CCSE to augment its program evaluation plan with several specific directives, including:

- *A market impact report for the first 12 months of the pilot that includes a review and analysis of project and participant characteristics, market changes, rebate effects,*

[6] California Energy Efficiency Policy Manual, Version 4.0. August 2008
[7] A. 08-07-021
[8] Assigned Commissioner's and Administrative Law Judge's Ruling Approving Solar Water Heating Pilot Program, issued 2/15/2007 in Commission Rulemaking 06-03-004

supplier and installer participation, market potential, and an empirical analysis of price elasticity of demand and barriers to increasing penetration.

- *An impact evaluation report to measure energy savings based on the metered data. This should include an analysis of the technical efficiency of installed systems, including reductions in billed kWh or therms, heat/energy transfer performance, and system degradation after one year.*

- *Cost-effectiveness evaluations as directed by the Commission in a future order on a distributed generation cost-benefit methodology*

- *An analysis of system costs before and after the pilot program, including system payback period and return on investment and, as described in D.06-01-024, a comparison of solar water heating prices in regions with and without incentives over the course of the SWHPP.*[9]

Further, the Ruling dismissed requests to expand the pilot statewide, stating that

> *"the full Commission may consider program expansion after it is able to review program evaluation results."*[10]

In accordance with the Ruling, CCSE began the SWHPP on July 2, 2007. At that time, the SWHPP was scheduled to end on December 31, 2009. After the SWHPP roll-out, CCSE issued a request for proposals for a measurement and evaluation contractor to oversee the evaluation of the SWHPP. CCSE selected Itron for this role and worked with Itron to develop an evaluation plan targeted to address the questions and concerns raised in the Commission's February 2007 Ruling. Itron released its SWHPP Interim Evaluation Report on January 30, 2009, and the Addendum to the report, which presents Itron's SWH cost-effectiveness analysis, on April 1, 2009.

2.7.2 Petition to Modify the SWHPP

On April 3, 2008, CCSE and California Solar Energy Industry Association (CalSEIA) filed a petition to expand the SWHPP into the territories of all three investor-owned utilities and extend the pilot by six months. CCSE and CALSEIA also requested changes to the incentive level and program budget for residential systems, additional funds for administration of the pilot, and allocation of funding responsibility for the pilot between PG&E, SCE, and SDG&E ratepayers through a co-funding agreement.

In D.08-06-029, the Commission partly accepted and partly denied the petition. The Decision enacted several program changes, including: 1) the SWHPP was extended through December 2009 or until the funding was exhausted; 2) new residential and commercial construction was allowed to participate; 3) the market research evaluation was expanded beyond San Diego; 4) unspent funds from the pilot could be used for the expanded market research; 5) the incentives remained limited to SDG&E customers

[9] Ibid., p. 9
[10] Ibid., p. 13

through the length of the pilot; and 6) the Energy Division was to hold a workshop on the SWHPP evaluation plan within 60 days of the ruling.

The Decision also stated that the Commission

> *"...Cannot design a statewide incentive program for solar water heating until it makes certain findings after an evaluation of the CCSE SWHPP."*[11]

More specifically, the Decision indicated the statewide program incentivizing natural gas-displacing SWH can only be established

> *"After a public hearing that a solar water heating program is cost-effective for ratepayers and in the public interest."*[12]

Lastly, the Decision encouraged

> *"CCSE, and other interested parties, to work with the Energy Division as described above to augment the pilot evaluation with additional research into what type of market interventions are needed to drive greater adoption of solar water heating systems in California".* [13]

2.7.3 SWHPP and AB 1470

Energy Division held a workshop in August 2008 where stakeholders discussed how to expand and improve the SWHPP evaluation. At this workshop, Itron discussed its interim evaluation findings and proposed a methodology for assessing the cost-effectiveness of a SWH incentive program. Based upon input provided at this workshop and internal discussions, Itron, CCSE and Energy Division developed a scope of work for a comprehensive evaluation of both the SWHPP and the SWH market across California.

After the August workshop, CCSE, Itron and Energy Division worked together to augment the scope of the evaluation of the SWHPP to directly answer the questions surrounding the cost-effectiveness of SWH raised in D.06-01-024 and AB 1470. Out of this work, the evaluators made two major additions to the evaluation plan.

1) Expansion of SWH market research statewide
2) Cost-benefit analysis that takes into account market transformation impacts of SWH and sensitivity analyses that consider different scenarios where SWH is cost-effective during and at the end of a statewide incentive program

In Jan. 2009, Itron released its *Interim Evaluation* of the SWHPP, which assesses the state of the California SWH market and sets forth a methodology for assessing the cost-effectiveness a SWH incentive program, as required by AB 1470. The proposed

[11] D.08-06-029, Conclusions of Law 4
[12] Ibid., Findings of Fact 3
[13] Ibid., p.10

methodology is based on the approach used to evaluate the Self-Generation Incentive Program (SGIP) but was modified to allow an assessment of cost-effectiveness at two separate points in time and under different market scenarios.

2.7.4 SWHPP Current Status

The Interim Evaluation and Addendum evaluate the status of the SWHPP, present data on market conditions for SWH in California and elsewhere, introduce a methodology for evaluating the cost-effectiveness of SWH and present the results of the cost-benefit analysis. The following section is an overview of the SWHPP status.

2.7.5 SWHPP Program Participation

In the 20 months since the start of the SWHPP, it has received a little less than 190 applications.

While this figure is significantly lower than the 750 incentive applications it was designed to accommodate, it represents the single largest concentration of SWH systems known to be actively installed in California. See Table 1.

Table 1: SWHPP Current Applications and Incentives

Total Applications	Total Reserved Applications	Reserved Incentive Amount	Total Paid Applications	Paid Incentive Amount
Retrofit				
• Prescriptive*	148	$181,516	107	$133,959
• Area^	14	$36,240	12	$33,900
New Construction	11	$16,000	1	$7,700
• Prescriptive*	0	$0	0	$0
• Area^				
Total	**173**	**$233,756**	**120**	**$175,559**

* The prescriptive method of calculating incentives is primarily used for residential customers.
^ The area method of calculating incentives is used only for large, innovative systems.

The vast majority of applicants to the SWHPP have been residential customers. Of those, 44% have used their SWH system to displace natural gas usage, 32% have displaced electricity and 24% have displaced other fuels (mostly propane) as shown in Table 10. Data collected from the SWHPP provides a fairly accurate and current depiction of the current state of the SWH market in California, including the average cost and energy savings of SWH systems. This information can be used in our design and implementation of a statewide SWH program.

Table 2: Summary of SWHPP Residential System Characteristics

Summary	Percent of Total	Average Incentive	Average Savings per year	Average Cost
Residential NG	44%	$1,189.63	117 therms	$6,457.38
Residential Electric	32%	1,295.16	2697 kWh	$6,539.55
Residential Other	24%	1,292.13	NA	$6,700.74

2.7.6 SWHPP Incentive Structure

The SWHPP incentive structure offers two options: the prescriptive method and the area method. The prescriptive method is used for residential and other small multifamily or commercial system installs. The residential customer must install an SRCC OG-300-rated system. The maximum incentive under the prescriptive method is $1,500 and is dependent on the orientation of the system and the SRCC Annual Savings Rating for that system in that climate zone.

In contrast, the area method is used for large multifamily, commercial, or other innovative systems, and the collectors must be SRCC OG-100-certified. The area method is based on the solar orientation factor; the SRCC Collector Performance is multiplied by $15 for an open loop system and $20 for a closed loop system. The maximum incentive provided is $75,000, and systems that receive an incentive under the area method must have at least one month of post-installation metering.

2.7.7 SWHPP Marketing and Outreach Activities

Over the course of the SWHPP, CCSE conducted various marketing and outreach activities to raise awareness of SWH and the SWHPP. CCSE employed a broad spectrum approach to marketing including television, radio, print, web, direct mail, email blasts, and community outreach. Media events were intended to maximize exposure within the limited marketing budget. Marketing collateral included: program and technical handbooks, brochures, flyers, "Quick Facts" sheets, questionnaire/surveys and HTML advertisements for e-blasts and web banners.

In addition to CCSE's marketing activities, it also held trainings, workshops and courses in SWH for homeowners and contractors. CCSE collaborated with the following partner organizations to broaden exposure to the SWHPP and maximize number of participants:

- **Green*Plumbers:*** CCSE works with Green*Plumbers*® members to promote the SWHPP by providing free workshops and certification in the areas of SWH, water conservation, and climate care for interested plumbers.
- **San Diego County Apartment Association (SDCAA).** CCSE worked with the 2,700-member SDCAA to promote SWH to apartment facilities with central boilers. SDCAA hosted two workshops on the SWHPP and included it in an environmental roundtable discussion at the SDCAA annual expo.

- **California Solar Energy Industries Association (CALSEIA).** CALSEIA has helped CCSE provide contractor support and training for the SWHPP.
- **Solar Rating and Certification Corporation (SRCC).** CCSE participated in the SRCC Standards Subcommittee, which established technical specifications for SWH systems. The subcommittee responded to standards-related concerns within the SWHPP. SRCC staff contributed to contractor and inspector training over the first 18 months of the program.

2.7.8 SWHPP Lessons Learned

The SWHPP has revealed useful information about marketing and outreach, SWH equipment requirements, installation practices, permitting procedures, and other issues. In terms of marketing and outreach, the SWHPP experience illustrated that increasing general public awareness of SWH can have tangible effects on participation in an incentive program. At the present time, however, lack of awareness remains a next-level barrier that must be overcome for a SWH incentive program to succeed.

For equipment requirements, the SWHPP has demonstrated that approaches for ensuring adequate freeze protection vary widely in the marketplace, with some systems more vulnerable to water quality issues than others. Additionally, storage tank requirements might have to be more flexible than the SRCC standards in a statewide program.

On the installation side, the SWHPP showed that there was wide variation in SWH system insulation quality and method of freeze protection, particularly for outdoor-exposed pipes. Further, the program showed that installers could benefit from education on proper installation of components and practices meant to protect against freezing and thermal migration. Another lesson learned was that an anti-scald requirement needs to be a minimum eligibility requirement for a SWH incentive program.

The SWHPP experience also brought to light problems with the permitting process for SWH. In some cases building officials were unfamiliar with SWH technologies and were reticent to permit SWH systems, while other building departments set permitting fees that cost up to 10% of the total system cost.

3. Cost-Effectiveness of SWH

Legislative statute and Commission Decision require the Commission to analyze the economics of SWH and answer certain questions about the cost-effectiveness of the technology and the provision of incentives before implementing a statewide SWH incentive program. The Commission explicitly stated in D. 08-06-029 that incentives should not be offered statewide for SWH until the SWHPP has been evaluated and certain findings have been made:

"4. The Commission cannot design a statewide incentive program for solar water heating until it makes certain findings after an evaluation of the CCSE SWHPP."[14]

Moreover, there may be different cost-effectiveness considerations depending on whether the SWH system is displacing electricity or natural gas.

- In the case of gas-displacing SWH authorized via AB 1470 (see Appendix B), we must analyze an 8-year incentive program and determine whether the provision of monetary incentives for natural-gas displacing SWH would be "cost-effective for ratepayers and in the public interest."[15]

- For electric-displacing SWH to qualify for incentives under the CSI Program we should consider prior Commission decisions. In January 2006, the Commission issued a decision questioning the need for solar water heating incentives if those systems are already cost effective for system owners without incentives.[16] Additionally, staff recommends that incentives should be offered for electric-displacing SWH if doing so would be "cost-effective and in the public interest," in order to be consistent with AB 1470.

3.1 Cost-Effectiveness Requirements

3.1.1 Natural Gas-Displacing SWH

As discussed above, AB 1470 requires the Commission to assess whether a statewide incentive program for natural gas-displacing SWH is cost-effective for rate-payers and in the public interest. The first step in making this determination is defining "cost-effective and in the public interest." Here, Energy Division proposes a definition that would then serve as the basis for making recommendations on the issue of cost-effectiveness for ratepayers and public interest value of a SWH incentive program.

Cost-effectiveness analysis compares the total sum of the benefits of an investment with the total sum of the costs. The benefits and costs are discounted over a specified time period using a specified discount rate to get a benefit-cost ratio. If the benefit-cost ratio

[14] D. 08-06-029, Ordering Paragraph 4
[15] California Public Utilities Code § 2863
[16] D. 06-01-024, p. 12-13

of an investment is greater than 1.0, then the benefits outweigh the costs and the investment can be considered cost effective. Energy efficiency programs use the standardized benefit-cost methodology that has been adopted in the California Standard Practice Manual (SPM).

Energy Division proposes that the methodology described above be used as the basis for assessing the SWH incentive program cost-effectiveness for the purposes of offering incentives under AB 1470. Furthermore, Energy Division proposes that SWH cost-effectiveness analysis consider the effects of market transformation – changes in the marketplace resulting from widespread deployment of SWH technology.

This proposal is consistent with both AB 1470 and D. 08-06-029, which state that market transformation should be a goal of the SWH Program:

> *"…it is the goal of this article to install at least 200,000 solar water heating systems on homes, businesses, and government buildings throughout the state by 2017, thereby lowering prices and creating a self-sufficient market that will sustain itself beyond the life of this program.*" (P.U. Code, Section 2862 (k))

The inclusion of market transformation in the larger cost-effectiveness assessment is also consistent with the general treatment of solar technologies under the CSI Program. One of the primary objectives of CSI is to provide financial incentives for solar technologies that are not currently cost-effective such that they are cost -competitive by 2017.

3.1.2 Electric-Displacing SWH

In D.06-12-033, the Commission stated its intent to include solar water heating in the CSI Program to promote use of that technology and reduce demand for electricity and natural gas. At the same time, however, the Commission noted that subsidizing the technology could unintentionally increase retail costs if SWH itself is already cost-effective without incentives.

> *"…[S]olar water heating may already be cost-effective and providing incentives under the circumstances may have the unintended effect of increasing the cost of solar water heaters."*[17]

For that reason, the Commission prohibited incentives for SWH through CSI Program until a determination could be made on the extent to which incentives are needed to promote the technology.

> *"Solar water heating incentives should be provided only as part of a closely monitored SWHPP as set forth herein."* [18]

In a February 2007 Ruling[19], the Commission also dismissed requests to expand the SWHPP statewide, stating that

[17] D.06-12-033, p. 12-13
[18] Ibid, p. 40

> *"...the full Commission may consider program expansion after it is able to review program evaluation results."*[20]

While the February 2008 Ruling explicitly denied the expansion of the SWHPP across the state, it did lay the framework for reconsidering whether to make SWH eligible for CSI incentives. In keeping with the intent of the ruling, the first test for determining whether electric-displacing SWH should be afforded incentives under the CSI program should be whether or not the technology is already cost-effective in the absence of incentives.

If electric-displacing SWH is not already cost-effective without incentives, the Commission should then consider the same cost-effectiveness test it applies to the natural gas side, i.e. is the program "cost-effective for ratepayers and in the public interest?" This Staff Proposal recommends providing incentives to electric-displacing SWH if the technology is not yet cost effective for those employing it and if the provision of incentives would be cost-effective for ratepayers and in the public interest.

3.1.2.1 Cost-Effectiveness Methodology

To answer the questions of cost-effectiveness related to SWH, the *Interim Evaluation* introduced a methodology based on a modified version of the SPM, which was originally developed for evaluating the cost-effectiveness of energy efficiency programs.

When attempting to make a determination on whether or not a program is cost-effective, it is crucial to determine the perspective from which the program is analyzed. In any incentive program, different costs and benefits will accrue to different parties. Costs and benefits to ratepayers participating in the program will be different from those of non-participating ratepayers. In the *Interim Evaluation,* Itron examines cost effectiveness from three perspectives: the participating ratepayer (Participant Test), the non-participating ratepayer (Non-Participant or Ratepayer Test), and society as a whole (Societal Test).

Energy Division proposes using the Societal Test to determine whether a SWH incentive program is cost-effective for ratepayers and in the public interest. This choice is consistent with the Commission's Energy Efficiency programs, which uses the Total Resource Cost Test (similar to the Societal Test) as the primary indicator of cost-effectiveness[21]. Using the Societal Test is appropriate for determining cost-effectiveness to ratepayers because it captures benefits that accrue to ratepayers (such as avoided pollution) that are not included in either the participant or non-participant test.

Similarly, the Societal Test is the appropriate test for determining whether a statewide SWH incentive program is in the public interest. Since a result that is "in the public

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[19] Assigned Commissioner's and Administrative Law Judge's Ruling Approving Solar Water Heating Pilot Program, issued 2/15/2007
[20] Ibid, *p. 13*
[21] CPUC Energy Efficiency Policy Manual Version 4.0, p. 8

interest" can be defined as one where the benefits to the public as a whole outweigh the costs, we can analyze a SWH incentive program from the public interest perspective by weighing all the costs to the public against the benefits that accrue to the public, including environmental benefits, job creation and reduced energy costs. This result is captured in the Societal Test.

Although Itron included the Nonparticipant Test (also referred to as the Ratepayer Test) in its analysis, Itron report strongly recommends against basing cost-effectiveness determinations on that test, as it mainly reflects the difference between wholesale and retail energy prices. Originally designed to evaluate energy efficiency programs, the non-participant test has been largely discontinued as a tool of analysis for those programs, and we therefore do not present the results of that test in this staff proposal.

To identify the appropriate values for benefits and costs through the life of the program, we must determine changes in the marketplace that can reasonably be expected to occur by that time. Itron analysis accounts for the range of possible future variation by examining four scenarios, each with varying degrees of change in the market: Present day (2008), Business as Usual--2017 (BAU), Moderate Changes--2017 (MOD) and Greenhouse Gas Driven—2017 (GHG)[22]. The modified SPM methodology is then applied to determine whether incentives for SWH are cost-effective in each of the scenarios. In the *Addendum,* cost-effective was assumed to mean a benefit-cost ratio of greater than 1.0 for both the Participant Test and the Societal Test for a given scenario.

Once benefit-cost values were obtained for the three future scenarios, sensitivity analyses were conducted to discern the factors that have the greatest influence on cost-effectiveness. As part of this analysis, Itron found that offering incentives to a mix of single-family, multifamily, and commercial SWH systems is more cost-effective than offering incentives only to SWH systems on single-family residences. Thus, for the purposes of this analysis, 40% of incentives were allocated to residential projects and 60% to commercial projects, a mix designed to optimize cost-effectiveness.

Below is a description of the four scenarios relevant to AB 1470 that are analyzed in the *Addendum:* Present Day (2008), Business as Usual - 2017 (BAU), Moderate Change – 2017 (MOD) and Greenhouse Gas-driven - 2017 (GHG).

Present Day (2008): This scenario is based on the installations carried out in just one year, but it does include the expected future benefits such as reduced energy bills for the life of the SWH system, sales of environmental attributes, and other factors which extend beyond the first year. Table 11 shows cost benefit ratios for various technology types and customer classes. Electric-displacing SWH is shown for all applicable customer classes with and without incentives to address the question of whether or not the technology is already cost effective for system owners in the absence of incentives. The assumptions underlying the 2008 scenario are:

- Present day electricity rates/natural gas rates
- $6,500 average cost for a SWH system

[22] All four are described in detail in the *Interim Evaluation* Report).

- $1,500 incentive per system (based on prevailing SWHPP incentive)
- 30% federal investment tax credit
- SWH systems save an average of 117 therms/yr or 2,735 kWh/yr

Business As Usual (BAU): In this scenario, benefits and costs are calculated over the lifetime of the program, rather than for a single year. Natural gas prices are assumed to increase by 4.0 percent each year, which falls between the CEC-forecasted rate of 2.5 percent per year[23] and the five-year average rate increase of 7.0 percent per year. Under the BAU scenario, 57,910 SWH systems are installed, displacing 895 million therms over the lifetime of the systems. The assumptions underlying the BAU scenario were:

- 4% per year increase in natural gas rates (through 2017)
- $200 million in incentives and total program budget of $250 million
- $6,500 average cost for a residential SWH system
- 30% federal investment tax credit
- SWH systems save an average of 117 therms per year
- Carbon credits worth $8 (2008) to $160.68 (2027)

Moderate Change (MOD): Natural gas prices are assumed to grow at 7.0 percent per year and the value of the environmental attributes is assumed to increase in conjunction with greater demand for carbon credits. The MOD scenario assumes that an increased number of single-family new homes will adopt SWH beginning in 2011 due to Title 24 energy efficiency requirements. The assumptions underlying the MOD scenario were:

- 7% per year increase in natural gas rates (through 2017)
- $200 million in incentives and total incentive program budget of $250 million
- $6,500 average cost for a SWH system
- 30% federal investment tax credit
- SWH systems save an average of 117 therms per year
- SWH is required in 2011 Title 24 update for new residential construction, and these systems are not eligible for program incentives
- Carbon credits worth $20 (2008) to $220.46 (2027)

Greenhouse Gas-Driven (GHG): Under this scenario, natural gas prices are assumed to rise at an annual rate of 10 percent, and carbon credits become increasingly important. In addition to the increased value of carbon credits, energy displaced through the use of SWH systems becomes eligible to participate in energy efficiency programs and renewable portfolio standards. The assumptions underlying the GHG scenario were:

- 10% per year increase in natural gas rates (through 2017)
- $200 million in incentives and total incentive program budget of $250 million
- $6,500 average cost for a SWH system
- 30% federal investment tax credit
- SWH systems save an average of 117 therms per year

[23] California Energy Commission. *2007 Final Natural Gas Market Assessment: In Support of the 2007 Integrated Energy Policy Report*. December 2007. CEC-200-2007-009-SF.

- SWH required in 2011 Title 24 update for new residential construction, and these systems are not eligible for program incentives
- SWH systems can generate trade-able credits eligible for RPS and EE programs
- Carbon credits worth $100 (2008) to $271.83 (2027)

3.1.2.2 Cost-Effectiveness Findings for Natural Gas-Displacing SWH

Table 12 shows that the program authorized by AB 1470 would be cost-effective under MOD and GHG scenarios, which predict higher natural gas prices than the BAU scenario. For this reason, we focus on the BAU scenario, which is the most conservative scenario and the only one that produced a B/C ratio of less than one. It is important to note that the focus on the BAU scenario does not derive from a belief that it is the most likely of the three scenarios. Rather, we focus on the BAU scenario because it is the "worst-case" scenario from the perspective of SWH cost-effectiveness, and we wish to see whether there are any likely changes in the SWH marketplace that would make an incentive program cost-effective even under this "worst-case" outlook.

To determine what, if any, additional factors would lead to benefit-cost ratios of one or greater under this scenario, sensitivity analysis was applied to the BAU scenario. Through this analysis, SWH system cost reductions were identified as a potential driver of cost-effectiveness. Specifically, a 16% reduction in SWH system costs by 2017 increased the BAU benefit-cost ratio to 1.00 for the Societal Test.

Table 3: Benefit-Cost Ratios for Natural Gas Displacing SWH

Scenario	Societal Test	Participant Test
Present Day (2008)	0.65	0.93
Business as Usual (BAU)	0.85	1.04
Moderate Change (MOD)	1.30	1.36
Greenhouse-Gas Driven (GHG)	2.36	2.08
BAU with 16% system cost reduction	1.00	1.23

The sensitivity analyses also revealed other key changes in the marketplace which, if they occurred together, would result in a cost-effective program. These changes include:

- The availability of loans through an property tax based financing program (e.g. an AB 811 type program[24]), a bank, or a SWH company, would improve incentive program cost-effectiveness by providing low-cost financing.

- SWH installations on new construction single-family homes should be prioritized under Title 24 in order to further transform the market. The cost of a SWH installation on a new home is about 20 percent less than the cost of a retrofit system.

[24] AB 811 (Levine, 2008) authorizes cities to create voluntary opt-in property tax assessment districts that allow willing property owners to finance public improvements and repay the costs of the loan via property tax payments.

- The increase in trained system installers needed achieve the adoption rate assumed in the model would also create jobs and potential reducing labor costs.

3.1.2.3 Implications for AB 1470 Program Design

The *Addendum* concluded that the BAU scenario could result in a cost-effective SWH incentive program with a single modification to the fundamentals of the scenario, a 16% reduction in the cost of SWH systems by 2017. Energy Division agrees that a reduction in the cost of SWH systems of 16% is reasonable because there are a number of pathways to achieve this reduction, either by a significant cost decline to a single cost category[25] or small declines in several categories. For comparison, the cost of SWH systems declined 30% between 1980 and 1990, the decade when California last offered SWH incentives.[26] We feel it is reasonable to expect a further cost decline of roughly half that magnitude over the next decade as the SWH market grows..

The *Interim Evaluation* identified some potential opportunities to realize reductions:

- **Reduced Equipment costs**: A 25% reduction in equipment costs would result in an 18% reduction in total system cost, and would drive a SWH incentive program to be cost-effective[27]. Some examples of opportunities to reduce equipment costs are the introduction of new materials in SWH systems (ex: plastic piping rather than copper) which could result in reductions of up to 50%.

- **Reduced Labor costs**: Labor cost reductions can also drive down total system costs, but to a lesser degree than equipment costs reductions. For example, a 25% decrease in labor costs would lead to a 5% reduction in total system cost. Labor costs could be reduced by introducing cookie cutter/plug-and-play SWH systems, which would reduce need to custom engineer SWH systems and shorten installation time.

Though equipment and labor costs represent the two largest cost components of SWH, there are also opportunities to reduce costs in areas like marketing and permitting. In particular, providing state-funded marketing and outreach would increase awareness of SWH and reduce per-system marketing costs for installers. Incentive program outreach to local building departments could reduce the monetary and transactional costs of permitting. In aggregate, Energy Division believes that a SWH incentive program can help the SWH market achieve significant cost reductions and to this end, we will include specific recommendations in the Program Design section of this Staff Proposal.

Itron's analysis showing that the modified BAU scenario is cost-effectiveness implies that the SWH incentive program envisioned in AB 1470 can, with reasonable assumptions about changes in the SWH marketplace, be cost-effective for ratepayers and in the public interest. Energy Division recommends that the Commission adopt Itron's

[25] Five SWH cost categories were identified in the *Interim Evaluation.* They were: Equipment, Permit, Labor, Warranty, Other. (p.6-9, *Interim Evaluation).*
[26] California Energy Commission, Consumer Energy Center. http://www.consumerenergycenter.org/renewables/solarthermal/hotwater.html
[27] *Interim Evaluation,* p.6-8

cost effectiveness analysis as described in the *Interim Evaluation* and *Addendum.* Given that this finding meets the cost-effectiveness threshold set by AB 1470, Energy Division proposes that the Commission begin the process of designing and implementing a SWH incentive program for natural-gas displacing systems as described in that legislation. Energy Division will present a proposal for program design and implementation in Section 3 of this document.

3.1.3 Cost-Effectiveness Findings for Electric-Displacing SWH

The first determination we make with regards to electric-displacing SWH is whether or not the technology is currently cost-effective for those employing it in the absence of incentives. Table 4 shows cost-effectiveness for electric-displacing systems for system owners under current conditions. Absent incentives, SWH technology is not cost-effective when employed on single-family homes, although it is cost-effective when used in multifamily applications. The results of the Societal Test are not presented for the present-day (2008) scenario because the Societal Test is only relevant for considering the costs and benefits of the full eight-year program.

Table 4: Cost-effectiveness for Electric-Displacing SWH in 2008

Scenario	Sector	Participant
2008 (with incentive)	Single-Family	1.14
	Multifamily	1.27
	Combined Total:	**1.23**
2008 (no incentive)	Single-Family	**0.95**
	Multifamily	1.15
	Combined Total:	**1.10**

Next, as a matter of policy, the Commission should weigh a potential incentive program for electric-displacing SWH on the same criteria it uses to evaluation an incentive program for natural gas-displacing SWH. Table 5 shows the cost-effectiveness of an eight-year incentive program under the BAU, MOD and GHG scenarios. Itron found that provision of incentives for electric-displacing SWH would be cost-effective for both program participants and society under all three scenarios.

Table 5: Cost-effectiveness for Electric-Displacing SWH in 2017

Scenario	Participant test	Societal Test
Business as Usual (BAU)	1.34	1.09
Moderate Change (MOD)	1.67	1.47
Greenhouse-Gas Driven (GHG)	2.17	2.06

Energy Division recommends that the Commission adopt Itron's cost-effectiveness analysis of electric-displacing SWH heating. Because this analysis shows that electric-

displacing SWH on single-family homes is not currently cost-effective for system owners in the absence of incentives, we believe it is unlikely the provision of incentives for these systems will result in increased costs and additional rents to system suppliers. Moreover, Itron's analysis shows that providing incentives for electric-displacing SWH would be cost-effective from the Societal perspective. For these reason, we recommend that the Commission make SWH eligible for incentives under the $100.8 million CSI fund for electric-displacing technologies.

Multifamily SWH applications that displace electricity are already cost-effective without incentives. Because electricity is a more expensive means to heat water than natural gas, commercial businesses are not likely to employ electricity for water heating in significant numbers and were not considered for this analysis. Nevertheless, Energy Division recommends that multifamily and commercial customers employing SWH to displace electricity be eligible for incentives under the program. Energy Division makes this recommendation based on the reasoning that since these customers will provide funding for the program, it would be unfair to deny them the benefit of incentives. Moreover, because these customers are relatively small in number, it is unlikely that they will significantly impact the market price of SWH technology.

4. CSI—Thermal Program Design

In this section, Energy Division recommends a framework for the design of the CSI – Thermal Program. Where requirements differ between electric and natural gas-displacing systems, Energy Division offers specifics for both parts of the program. In all other cases, the proposal herein covers both applications for SWH. At the end of each section, the proposal is summarized in a one sentence recommendation.

4.1 Program Goals

The following is a set of programmatic goals that Energy Division recommends for both the natural gas and electric displacing components of the CSI-Thermal Program.

The four primary goals of the CSI-Thermal Program are to:

- Significantly increase the size of the SWH market in California by increasing the adoption rate of SWH technologies, including
    - Achieving the installation of natural-gas displacing systems that displace 585,000,000 therms
    - Achieving the installation of electric displacing SWH systems that displace 150 MW by the end of 2017
    - Achieve an expansion of the market for other solar thermal technologies that displace natural gas and electricity use, in addition to SWH
- Support reductions in the cost of SWH systems by approximately 16% through a program that increases market size and encourages cost reductions through market efficiency and innovation
- Increase consumer confidence and understanding of SWH technology and their benefits
- Reduce market barriers to SWH adoption, such as high permitting costs, lack of access to information, lack of trained installers by engaging in market facilitation activities

Recommendation: The CSI-Thermal Program should adopt a set of goals with respect to targeting a number of installations, reductions in SWH technology costs, increasing consumer confidence in and understanding of SWH technology, and reducing other market barriers to technology adoption.

4.2 Program Strategy

A successful SWH incentive program will be one that addresses the most pressing barriers to growth in the SWH market in California. In the *Interim Evaluation*, Itron identifies four primary barriers to SWH market growth:

1) Upfront installation cost
2) Lack of public knowledge about SWH
3) Permitting costs and requirements; and

4) Potential shortage of experienced SWH installers.

The SWH incentive program Energy Division proposes is aimed at using our limited program resources to address those barriers in the most cost-effective manner possible.

- The first barrier – upfront installation costs, can be addressed through a program of incentives to lower the upfront cost of solar thermal technologies. In addition, by growing the overall size of the market, the program can spur competition and innovation which will lead to market efficiencies and further reduce the upfront installation costs.
- The other three barriers identified above can be mitigated by finite, targeted expenditures in the Market Facilitation aspects of the CSI-Thermal Program, which will include marketing and outreach and is described in more detail below.

Recommendation: The CSI-Thermal Program should adopt a Program Strategy that addresses upfront costs via incentives and tackles other market barriers via the Market Facilitation aspects of the program.

4.2.1 Program Goals set in terms of Energy Displaced, rather than number of systems.

Energy Division recommends that the CSI-Thermal Program set its goals in terms of energy displaced instead of total number of SWH systems installed. We take this approach because different types and sizes of systems may displace different amounts of natural gas and electricity, and it is displacement of fossil energy that is the true goal of the program. For this reason, it is important to focus on energy displaced by participating SWH systems, instead of the absolute number of SWH systems installed. Moreover, the Interim Evaluation found that incentivizing larger commercial and multi-family SWH projects is more cost-effective than funding only small systems. By setting goals and paying incentives based on SWH energy displacement, the program will focus on promoting the deployment of the most cost-effective SWH systems.

Recommendation: The CSI-Thermal Program should set its goals in terms of energy displaced instead of total number of SWH systems installed.

4.3 Program Design Principles

Energy Division's CSI-Thermal Program proposal is informed by the view that a common-sense program of monetary incentives, combined with technical assistance, marketing, outreach and training, could accelerate the installation of SWH systems and promote the development of less expensive and more efficient SWH technologies. A CSI-Thermal Program could also bolster consumer confidence in the technology. Energy Division's proposal is premised on the idea that the current SWH market in California is unlikely to develop significantly without a state commitment to market support that is both long-term and financially certain for a fixed duration.

This staff proposal is based on the following set of Program Design Principles:

- The CSI-Thermal Program should build upon the existing CSI Program, as well as the existing statewide effort under the umbrella of the Go Solar California campaign and brand
- The CSI-Thermal Program should be based on a long-term commitment to provide incentives for non-pool solar water heating installations over the next 8-years (2010 - 2017)
- The CSI-Thermal Program will provide incentives to SWH systems that will be based on the performance of those systems, in order to promote the adoption of high-performing systems and to compensate system owners for the higher cost of doing so.
- The CSI Thermal Program should be designed to encourage solar water heating component manufacturers and system integrators to commit to high performance, lower-cost designs for SWH. Incentives will be reduced over time to reflect these performance gains and expected cost reductions.
- The CSI-Thermal Program structure, including incentive levels, will be regularly reviewed to ensure that ratepayers do not over-pay for the level of SWH adoption the Commission seeks.
- The CSI-Thermal Program will work to remove structural barriers to the deployment of SWH technologies through marketing, outreach and training.
- The CSI-Thermal Program Administrators will provide consumers with useful information about SWH technology ratings, performance, and costs.
- The CSI-Thermal Program will rely upon the lessons learned from the SWHPP to design a program that supports the creation of a stable SWH industry
- The CSI-Thermal Program will encourage customers to consider not only solar water heating applications, but also energy efficiency measures that offer attractive economic returns and other benefits such as comfort or convenience.
- The CSI-Thermal Program will be jointly administered to provide solar thermal incentives to both electric-displacing and gas-displacing technologies, as well as both solar water heating as well as other solar thermal technologies. There will be separate funding sources, as needed, but also some comingling of administrative funds in order to facilitate one joint program for all types of "CSI-Thermal" program offerings.

Recommendation: The CSI-Thermal Program should be based on a set of Program Design Principles that build upon the CSI Program, focus on rewarding high performing systems, and grow the size of the SWH market.

4.3.1 Program Start and Eligibility Date

Energy Division proposes that the CSI-Thermal Program begin accepting applications for incentives on January 1, 2010. We recognize that the release of this Staff Proposal may have the effect of forestalling activity in the SWH market until incentives are available. For that reason, Energy Division proposes that any SWH systems installed after the

release of this Staff Proposal be eligible for incentives under the CSI-Thermal Program, if this program is approved by the Commission and put into effect.

SWH systems installed after the release of this Staff Proposal but before the start of the CSI-Thermal Program would need to wait until start of the program before actually receiving their incentive. Potential applicants should recognize that this proposal is not yet final. Eligibility requirements and incentive levels could change before the program is approved in its final form, and the Commission may decide not to approve it at all. Systems installed between the release of this Staff Proposal and the start of the program would be subject to the eligibility requirements and incentive levels actually approved by Commission vote, rather than those we recommend in this Staff Proposal.

Recommendation: In order to prevent a "dead period" in the SWH industry, SWH systems installed after the release of this staff proposal should be eligible for incentives under the requirements and incentive levels of the program as it is approved in its final form.

4.4 Program Technology Eligibility

The CSI-Thermal Program is primarily designed to encourage the market for SWH technologies, but it does not preclude other solar thermal technologies that displace electricity or natural gas. Non-water-heating solar thermal technologies that displace electricity are already provided incentives via the CSI non-PV electric-displacing fund. In this staff proposal, we propose also providing incentives to non-water-heating solar thermal technologies that displace natural gas. We take this position keeping in mind the larger goal of displacing fossil energy with solar energy and with the view that all new technologies serving that function should be encouraged. The one exemption is solar pool-heating technologies, which are not recommended to be eligible for incentives through the CSI-Thermal Program.

All other solar thermal technologies that displace electricity or natural gas are eligible for CSI-Thermal Program incentives as long as they meet the equipment eligibility standards (See also CSI-Thermal Program Handbook development, Section 4.13.3) of the CSI-Thermal Program. Table 6 shows the technologies that are eligible for funding currently compared with what we are recommending in this Staff Proposal. Non-SWH technologies that displace natural gas should be offered the same incentive on a thermal displacement basis as natural-gas displacing SWH. Rules governing participation of non-SWH in the program should be established through the development of the program handbook, similar to rule development process for non-PV technologies in the CSI program.

- SWH is defined as a technology that uses solar thermal energy to heat water primarily for direct hot water end uses.
- "Other" (non SWH) solar thermal technologies include solar assisted space heating and space cooling, as well as solar thermal used for commercial and industrial processes.
- Passive solar technologies, such as solariums, are not eligible for incentives

Table 6: Technologies eligible for incentives under CSI-Thermal Program

	Technology	AB 1470 Program for Gas-Displacing Technologies	CSI General Market Solar Program for Electric Displacing Technologies
Current Situation	Solar Water Heating	No	No
	Other Solar Thermal	No	Yes
As Proposed in this Staff Proposal	Solar Water Heating	Yes	Yes
	Other Solar Thermal	Yes	Yes

Solar thermal technologies must be used to displace electricity or natural gas that would otherwise have been used by a grid-connected or gas-consuming customer in investor-owned utility territory in California. Solar thermal technologies that displace electricity or natural gas in new[28] or existing properties are eligible for incentives, including residences, multi-family or multi-tenant properties, commercial, agricultural, non-profit, and governmental properties.

Recommendation: The CSI-Thermal Program should provide incentives to SWH and other (non-SWH) solar thermal technologies, except for pool heating, in all new and existing facilities in investor-owned utility territories, so long as the customer would otherwise have consumed gas or electricity from the utility to serve that application.

4.4.1 SWH System Performance Monitoring

All non-residential SWH systems will be required to include performance monitoring and metering equipment and to make the system data available to program evaluation contractors for a minimum period of five years. All residential systems that have metering and performance monitoring included in the system will be required to make that data available for the purposes of program evaluation for a period of five years.

All residential systems that do not have metering and performance monitoring included in the cost of the system must agree to allow the program to install such equipment for the purposes of program evaluation. The CSI-Thermal Program Administrators and evaluation contractors will pick a representative sample of systems on which they will install metering equipment at the start of the program. These meters will be installed during system commissioning and prior to the dispersal of any rebate, in order to provide data by which estimated performance can later be verified.

Recommendation: All non-residential SWH systems should be required to include monitoring equipment and make performance data available to evaluation contractors for at least five years. Metering equipment should be installed on a representative sample of residential systems to verify expected performance.

[28] In the event that SWH becomes mandatory for new home construction, these homes would no longer be eligible for incentives under the CSI-Thermal program.

4.4.2 Natural Gas Displacing SWH Program Goals

AB 1470 sets a goal of installing of 200,000 natural gas-displacing SWH systems by 2017. Itron's *Interim Evaluation* and *Addendum* represent this goal in terms of total therms displaced in order to create equivalency between larger and smaller SWH systems that would participate in the program. Among the assumptions in these reports were that the average residential system would displace 117 therms per year. To derive a total therm displacement goal for the incentive program, this annual savings estimate was multiplied by 25 years (the assumed life of a SWH system) and then by 200,000 systems.

117 therms/yr x 25 yrs. x 200,000 SWH systems = 585,000,000 therms displaced

Recommendation: The Commission should adopt a goal of displacing 585,000,000 therms of natural gas for that component of the CSI-Thermal Program.

4.4.3 Electric Displacing SWH Program Goals

Neither SB 1 nor the CSI Program sets specific goals for SWH or other electric-displacing solar technologies. Because these technologies will receive incentives from the CSI PV program, which sets goals in terms of PV installed capacity, Energy Division recommends converting SWH electricity displacement into an equivalent electric generation capacity that can be directly compared with solar PV. The goal for electric-displacing SWH will be represented in terms equivalent to electric generating capacity, kilowatts (kW).

In the *Interim Evaluation,* Itron assumes that the average single-family electric displacing SWH system displaces 2,735 kWh per year. Dividing this quantity of energy by the amount of energy that a kW of PV will produce (1752 kWh per year[29]) gives us 1.56 kW.

Applicable SRCC rating (2735 kWh) / 1752 kWh = 1.56 kW

Thus, the average small electric-displacing SWH system displaces as much electricity as a 1.56 kW solar PV system produces. Energy Division proposes to use this equivalency for the purposes of accounting for the impact of SWH systems against CSI-PV Program incentive steps. Under this accounting formula, each residential electric-displacing SWH system would subtract 1.56 kW from the capacity of a given CSI-PV incentive step.

The next step in setting goals for the electric displacing component of the CSI-Thermal Program is to consider the proposed incentive structure. Energy Division recommends a flat $1,000 incentive for electric-displacing SWH systems. Dividing $100.8 million by $1,000, we get 100,800 as the total number of systems that can receive incentives under the CSI non-PV incentive budget.

If 100,800 is the maximum number of electric displacing SWH system that can receive incentives through the CSI-Thermal Program, and each of these systems is assumed to

[29] 8760 hours/year * 20% * 1 kW = 1752 kW-hours/year, where 20% is the capacity factor for California

have a capacity value of 1.56 kW, then the maximum capacity value of the electric displacing component of the CSI-Thermal Program equals:

100,800 x 1.56 kW = 157,248 kW

Assuming that the maximum capacity value of the electric displacing component of the CSI-Thermal Program is 157.25 MW[30], Energy Division recommends rounding down to set 150 MW as the high side goal, with the recognition of the fact that less than 10% of water heaters in California are electric powered. There are other technologies that also qualify for the CSI non-PV electric displacing budget, so it makes sense to "round down" to accommodate some other technologies within the $100.8 M budget.

Recommendation: The Commission should adopt a goal of displacing 150 MW of electric capacity for the electric displacing component of the CSI-Thermal Program.

4.5 Program Administration

Energy Division recommends creating a single administrative structure, the California Solar Initiative (CSI) – Thermal Program, for the purpose of administering all SWH heating incentives, whether for systems that displace electricity or those that displace natural gas. This program will encompass both the SWH incentive program envisioned in AB 1470 and the CSI non-PV electric displacing program.

Energy Division proposes that the CSI—Thermal Program be administered the same way as the CSI-PV Program, save for the inclusion of Southern California Gas (SCG) as an additional Program Administrator.

- In the service territories of PG&E and SDG&E, the current CSI-PV Program administrators will also be the Program Administrators for the CSI—Thermal Program. In this way, they will be able to disburse incentives to both electric and gas ratepayers who install SWH systems.
- In the service territories of SCE and SCG, SCE will administer a portion of the CSI—Thermal Program for customers who install electric displacing SWH, while SCG will administer the portion of the CSI—Thermal Program that serves their customers who install natural gas displacing SWH. Program Administration budgets are shown in Table 6.

[30] 157,248 kW = 157.25 MW

Table 7: SWH System Types Funded by Each CSI-Thermal Program Administrator

Program Administrator	Electric displacing Solar Thermal Systems	Natural gas displacing Solar Thermal Systems
PG&E	X	X
SCE	X	
CCSE (in territory of SDG&E)	X	X
SCG		X

.

Table 8: CSI-Thermal Program Administration Budget

Program Administrators	Administration, Incentive Processing and Inspections	Measurement & Evaluation
PG&E	**$7,662,692**	**$6 million**
SDG&E/CCSE	**$5,918,028**	
SCG	**$1,419,280**	
TOTAL	**$15,000,000**	

The above budget allocations are based upon Energy Divisions budget ratio in Table 12.

Energy Division has not made specific recommendations for how administration budgets should be allocated across the three major task areas, such as application processing, incentive disbursement, general administration, and inspection. The staff proposal recommends that the CSI-Thermal Program Administrators should have some leeway to determine how to best use their administration budgets. Energy Division recommends that CSI-Thermal Program Administrators submit detailed budget estimates in advance of the launch of the CSI-Thermal Program, and that the CSI-Thermal Program Administrators submit semi-annual expense reports on February 15th and August 15th that include data through December 31st and June 30th of each year. The expense reports should include disclosure of expenditures separated by direct and indirect expenses, labor and non-labor, for all of the major categories: including administration, market facilitation, evaluation, and incentives.

Recommendation: The CSI-Thermal Program should be administered by the same Program Administrators as the CSI Program, with the addition of SCG for the natural gas displacing program. The Program Administrators should have flexibility within the administration budget. The Program Administrators should submit an initial prospective budget for Commission review, as well as semi-annual expense reports on February 15th and August 15th of each year (that give information through December 31st and June 30th of each year).

4.5.1 Program Administrator Responsibilities

Energy Division recommends that the Program Administrators of the CSI-Thermal Program be responsible for the following task areas:

1) Timely program implementation that achieves the goals adopted by the Commission
2) Coordination on statewide, uniform program implementation, including, but not limited to:
    - Incentives Program, including: Application processing for incentives and system verification and inspections process and incentives payment processing.
    - Market Facilitation aspect of program, including activities to remove market barriers, such as marketing of SWH technology and incentive program, training for installers and outreach to local permitting officials,
3) Development of Program Handbook
4) Development of a Statewide Application Processing System and Program Database, including making real-time weekly program data available to the public to increase market transparency
5) Development of an optional reservation system for incentives, as well as information about availability of incentives on a per step basis
6) Recommend program design changes to the Commission on an as-needed basis
7) Conduct dispute resolution with program applicants
8) Host quarterly stakeholder meetings
9) Issue quarterly progress reports on program results, including program data and program implementation updates
10) Coordination with Energy Division on program evaluation
11) Submittal of expense reports to Energy Division on a semi-annual basis

Recommendation*: The Commission should adopt a set of Program Administrator Responsibilities, as detailed in this staff proposal.*

4.6 CSI-Thermal Program Budget

This staff proposal includes program budgets for both components of the CSI—Thermal Program.

4.6.1 Natural-Gas Displacing SWH Program Budget

For the purposes of setting the budget for the natural gas-displacing component of the CSI—Thermal Program, the Commission has significant flexibility. Energy Division's proposed budget for the natural gas-displacing component aims to address the most significant barriers facing the SWH industry in California.

AB 1470 gives the Commission the authority to collect up to $250 million from gas ratepayers for a SWH incentive program. Energy Division proposes to allocate the full

$250 million to the natural gas component of the CSI—Thermal Program. Energy Division proposes to divide this budget between incentives, market facilitation, and program administration. Table 9 below provides an overview the proposed allocation between various program elements.

Table 9: CSI-Thermal Program: Natural-Gas Program Budget

CSI—Thermal Program Elements	CSI—Thermal Program Sub-Elements	Budget	Percentage
Incentives	General Market Incentive Component	$180,000,000	72%
	Low-Income Incentive Component	$20,000,000	8%
	Subtotal	***$200,000,000***	***80%***
Market Facilitation	Marketing & Outreach, including training, consumer education, and other market facilitation activities such as engaging with permitting offices or financing providers.	$25,000,000	10%
	Subtotal	***$25,000,000***	***10%***
Program Administration	Application/incentive processing, General Administration, and System Inspection	$15,000,000	6%
	Measurement and Evaluation	$10,000,000	4%
	Subtotal	***$25,000,000***	***10%***
	Total	**$250,000,000**	

Recommendation: The Natural Gas portion of the CSI-Thermal Program should adopt a $250 million budget, divided as follows: 80% for Incentives, 10% Market Facilitation, and 10% for Administration and Measurement & Evaluation.

4.6.2 Electric Displacing SWH Program Budget

SB 1 and the Commission Decisions that established the CSI Program include specific budget allocations for CSI Incentives, as well as Program Administration, which includes administration, marketing & outreach, and measurement and evaluation. The CSI Program also has specific monies set aside for low-income programs.

For the purposes of the CSI—Thermal Program, the budget for the electric-displacing component will be included within the larger CSI Program budget. The only budgetary constraint is that SB1 limited the CSI program to spend no more than $100.8 M for non-PV technologies.[31] Therefore, this proposal recommends that the CSI-Thermal program spend up to that full amount of $100.8 M on incentives for electric displacing thermal

[31] P.U. Code, Section 2851 (b) states "Notwithstanding subdivision (a), in implementing the California Solar Initiative, the commission may authorize the award of monetary incentives for solar thermal and solar water heating devices, in a total amount up to one hundred million eight hundred thousand dollars ($100,800,000)."

technologies, including SWH. If the monies are not spent or reserved on the CSI-Thermal program, then the funds will be available to the overall CSI program (i.e. the solar PV general market program). As noted in Section 4.12, the electric-displacing portion of the CSI-Thermal program will not have a budget for low-income customers, so that portion of the budget will be zero.

This proposal recommends that the administration, marketing and outreach, and evaluation tasks associated with providing incentives for electric-displacing solar thermal program will be funded by the overall CSI program budget. The Commission has established that not more than 10% of the CSI budget can be spent on administration (See D.06-08-028), has established an Evaluation budget (See Ruling, July 29, 2008), and has established that up to $500,000 per year per program administrator could be spent on marketing and outreach (M&O) (See D.07-05-047). The Commission is expected to consider a long-term M&O plan that may allocate additional dollars for CSI M&O.

This staff proposal recommends that the CSI-Thermal Program Administrators handle funding for the CSI-Thermal program as part of the CSI budget in the following way:

- The CSI-Thermal program should track the funds incurred for administering the electric-displacing portion of the program separately from the CSI program, even though the funds will all come from the same source. Each Program Administrator handles these funds separately—and so PG&E, SCE, and CCSE will have to track CSI Program Administration according to whether the administration supported the solar PV or the solar thermal aspect of the program (with the exception of SCG, which will not have any administrative costs associated with the electric-displacing incentives).
- The CSI-Thermal program will have evaluation costs. The evaluations should be funded by both the natural-gas displacing and the electric-displacing part of the program. Therefore, the CSI M&E program budget will have to be modified to account for the costs associated with funding evaluations for the CSI-Thermal program. The CSI-Thermal program should be funded for at least $5 Million in evaluation work from the Electric-displacing side.
- The CSI-Thermal program will have Market Facilitation costs, including Marketing and Outreach. The CSI program budget does not yet have a Long-Term M&O plan, but this staff proposal recommends that at least $12.5 M be set aside from within the CSI Long-Term M&O specifically to support the CSI-Thermal program.

Table 10: CSI-Thermal Program: Electric Displacing Program Budget

CSI—Thermal Program Elements	CSI—Thermal Program Sub-Elements	Budget
Incentive Program Component	General Market Incentive Component	$100,800,000
	Low-Income Incentive Component	$0
	Subtotal	***$100,800,000***
Market Facilitation Program Component	Marketing & Outreach, including training, consumer education, and other market facilitation activities such as engaging with permitting offices or financing providers.	$12,500,000
	Subtotal	***$12,500,000***
Program Administration	Application/incentive processing, General Administration, and System Inspection	Subject to the overall CSI budget, but tracked separately
	Measurement and Evaluation	$5,000,000
	Subtotal	***$5,000,000***
	Total	**$118,300,000 + CSI Admin Budget Costs**

Recommendation: The Electric Displacing portion of the CSI-Thermal Program should adopt a budget of $118,300,000 million, exclusive of Program Administration Costs. The non-administrative costs will be divided as follows: 85% for Incentives, 10% Market Facilitation, and 5% for Administration and Measurement & Evaluation.

4.7 Mixing Program Budget for CSI-Thermal Program

The CSI-Thermal Program Administrators will have to draw funds from the electric-displacing budget and the natural gas-displacing budget in order to effectively implement the market facilitation and evaluation aspects of the program.

The CSI-Thermal Program may fund up to $200 M in direct incentives on the gas-displacing side, and it may fund up to $100.8 M in direct incentives on the electric-displacing side. Therefore, the administrative costs that need to be split by the two parts of the program should be co-funded on a ratio of 2:1, whereby for every $2 spent by the natural-gas displacing portion of the program, there will be $1 funded by the electric displacing portion of the program.

Table 11: Total CSI-Thermal Program Budget (Combined Electric and Natural Gas)

CSI—Thermal Program Elements	CSI—Thermal Program Sub-Elements	Natural Gas Displacing	Electric displacing	Total
Incentives	General Market Incentive Component	180,000,000	100,800,000	*$280,800,000*
	Low-Income Incentive Component	20,000,000	0	*$20,000,000*
	Subtotal	**$200,000,000**	**$100,800,000**	***$300,800,000***
Market Facilitation	Marketing & Outreach	**25,000,000**	**12,500,000**	***$37,500,000***
Program Administration	Application/incentive processing, General Administration, and System Inspection	15,000,000	Subject to the overall CSI budget, but tracked seperately	*$15,000,000*
	Measurement and Evaluation	10,000,000	5,000,000	*$15,000,000*
	Subtotal	**$25,000,000**	**$5,00,000**	***$30,000,000 + CSI Admin***
Total		**$250,000,000**	**$118,300,000**	***$368,300,000 + CSI Admin***

Recommendation*: The CSI-Thermal Program should have an overall budget of approximately $375.5 M. The Market Facilitation and Evaluation budgets should use comingled funds from the natural gas displacing and electric displacing funds, the funding should be on a ration of 2:1.*

4.8 CSI-Thermal Rate Collections

The CSI-Thermal Program should be funded by electric and gas ratepayers; however the collections for the natural gas-displacing budget should come exclusively from natural gas ratepayers, and the funding for the electric-displacing budget should come exclusively from electric ratepayers.

The Commission already established a rate collection schedule for the CSI program, as modified in D.08-12-044. There is no further action required by the Commission to enable these collections to occur for the CSI-Thermal program.

The Commission needs to adopt a rate collection schedule for the natural gas-displacing portion of the CSI-Thermal Program. Energy Division proposes using a schedule based on the proportions established by the natural gas public goods charge (PGC) collections for 2008 for each of the natural gas IOUs. Based on each utility's portion of the total amount of PGC collections for 2008, Energy Division recommends allocating 51% of the

program budget to SCG, 39% to PG&E and 10% to SDG&E[32]. The PGC will only be used to determine the proportion of total funding contributed by each utility. Actual funding for the program will be collected in distribution rates. Table 12 below shows the allocation of funds between program administrators for the natural-gas displacing portion of the CSI-Thermal Program.

Table 12: CSI-Thermal Program, Natural-Gas Displacing Budget Collections

Program Administrator	Budget Breakdown %	Total Program Collections	Incentives	Non-Incentives (administration, M&O)
PG&E	39%	$97.5 M	$78 M	$19.5 M
SCG	51%	$127.5 M	$102 M	$25.5 M
SDG&E	10%	$25 M	$ 20 M	$5 M
Total	**100%**	**$250 M**	**$200 M**	**$50 M**

For SDG&E and PG&E, the two utilities that will be collecting from both electric and gas customers, the Commission should order the utilities to keep the rate collections in separate memorandum accounts.

The rate collections for the natural gas portion of the program, the utilities should collect monies in rates starting January 1, 2010, and should continue to collect in rates through December 31, 2017. The budget collections specified in Table 12 should be collected in even increments for eight years, in accordance with rate design specified for other similar types of collections, such as the PGC charge.

Recommendation: The CSI-Thermal program rate collections for natural gas customers should be allocated as follows: 51% - SCG, 39% - PG&E, and 10% - SDG&E. The rate collections should occur in even increments over eight years. The CSI-Thermal program rate collections for electric customers should occur in accordance with existing CSI program decisions.

4.9 Incentive Design for CSI-Thermal Program

This staff proposal recommends the following incentives be offered through the CSI-Thermal program, as detailed in the incentive budget and design sections below.

CCSE and Itron identified upfront installation costs of SWH as the single most significant barrier to SWH system adoption. In their cost-effectiveness evaluation, both electric displacing systems and natural gas displacing systems fail to have a cost-benefit ratio greater than "1" in all cases, except multifamily properties. In simple terms, customer does not find that it is cost-effective to install solar water systems in the absence of incentives.

[32] PG&E AL 2683-G, SDG&E AL 1575-G, and SCG AL 3559-G

Table 13: Cost-effectiveness for program participants in present-day scenario for natural-gas displacing and electric-displacing SWH systems[33]

Sector	Natural-Gas Displacing	Electric-Displacing
Single-Family	0.80	0.95
Multi-Family	0.88	1.15
Commercial	0.99	N/A

To address this barrier, Energy Division proposes creating a CSI-Thermal program that offers incentives (at various and declining levels) that will help accelerate consumer adoption of SWH. Energy Division proposes an 8-year program of up-front incentives that are calculated based on the expected performance of the SWH system. These incentives will decline to match market growth and increased demand for SWH and the price declines Energy Division expects to see as a result of this growth. We propose to set the incentives at levels sufficient to offer SWH system owners a reasonable return on their investment in the technology, and these levels vary depending on whether the system displaces natural gas or electricity.

Incentive Program Design -- Natural Gas displacing SWH

- Incentives calculated based on estimated annual Therm displacement of SWH system
- Four incentives steps starting at avg. incentive of $1,500 per system and stepping down to $1,200, $900 and finally an avg. incentive of $600 per system
- Total program budget of $250 million[34], with $200 million budgeted for incentives
- Incentives offered for low-income customers through a special program.

Incentive Program Design -- Electric displacing SWH

- Incentives calculated based on estimated annual kWh displacement of SWH system
- One incentive step based on avg. incentive of $1,000 per system
- Total program budget of $118.3 (not including straight administration costs), and a maximum incentive budget of $100.8 million[35]

4.9.1 Eligibility for Incentives

All customer classes (single-family, multi-family and commercial) should be eligible for incentives under both the electric-displacing and natural-gas displacing CSI-Thermal Program. Applicants must be customers of PG&E, SDG&E, SCE or SCG.

4.9.2 Incentive Budget for Natural-Gas Displacing SWH Systems

Energy Division proposes to offer incentives for natural-gas displacing SWH systems via different pre-determined budgets depending on the customer class (the type of facility

[33] Itron Interim Evaluation Report, Appendum, April 1, 2009
[34] P.U. Code, Section 2863 (b) (2). See Appendix for full text.
[35] SB 1 capped the total amount of incentives that SWH could receive through the CSI at $100.8 million electricity displacing solar technologies (P.U.Code, Section 2851(2))

that the SWH system is installed on). In addition, the incentives should decline four times (per customer class) over the course of the program based on the number of systems installed. In Table 14, the staff proposal recommends a budget for the total funding available per step per customer class, on a statewide basis. The funding is split 40% residential (10% single family and 30% multifamily) and about 60% commercial. We recommend portioning the incentives in this manner because the Itron Interim Evaluation found that such a split would maximize the cost-effectiveness of the program.[36] The actual incentives per project, will be calculated on a per therm displaced basis, as discussed further in Section 4.11.

Table 14: CSI-Thermal Program Incentive Budget for Natural Gas Displacing Systems, Statewide Per Customer Class

Step	Customer class	Funding per Customer Class	Incentive for Average SWH System	Total Incentives Available at Funding Level
1	Single-family	$3,145,000	$1,500	$30,000,000
	Multi-family	$8,967,000	$11,525	
	Commercial	$17,888,000	$86,253	
2	Single-family	$5,242,000	$1,200	$50,000,000
	Multi-family	$14,945,000	$9,224	
	Commercial	$29,814,000	$69,029	
3	Single-family	$6,290,000	$900	$60,000,000
	Multi-family	$17,933,000	$7,156	
	Commercial	$35,776,000	$53,555	
4	Single-family	$4,194,000	$600	$40,000,000
	Multi-family	$11,956,000	$4,612	
	Commercial	$23,851,000	$34,515	
	Total (all Steps)			$180,000,000

The incentive budget shown in Table 14 shows each customer class per step. The incentive budget table is shown broken down per utility territory in Table 15. Once the budget has been exhausted for a particular customer class within the service territory of a particular program administrator, the incentive level will move to the next step for that customer class in that service territory. The Program Administrators will be required to keep a publicly available website, updated daily, detailing the amount of budget available per step.

[36] Itron Interim Evaluation Addendum, April 1, 2009

Table 15: CSI-Thermal Program Incentive Budget for Natural Gas Displacing Systems, Per Program Administrator Per Customer Class

Incentive step	Funding amount ($1,000s)		
Program Administrator	SCG	PG&E	CCSE (SDG&E)
Step 1 – single family	$1,607	$1,241	$298
Step 1 – multi family	$4,581	$3,538	$848
Step 1 – commercial	$9,138	$7,057	$1,693
TOTAL	$15,325	$11,836	$2,839
Step 2 – single family	$2,678	$2,068	$496
Step 2 – multi family	$7,635	$5,896	$1,414
Step 2 – commercial	$15,230	$11,763	$2,821
TOTAL	$25,543	$19,727	$4,731
Step 3 – single family	$3,213	$2,482	$595
Step 3 – multi family	$9,161	$7,075	$1,697
Step 3 – commercial	$18,276	$14,115	$3,385
TOTAL	$30,650	$23,672	$5,677
Step 4 – single family	$2,142	$1,655	$397
Step 4 – multi family	$6,108	$4,717	$1,131
Step 4 – commercial	$12,184	$9,410	$2,257
TOTAL	$20,434	$15,782	$3,785
TOTAL (all Steps)	**$91,953**	**$71,017**	**$17,031**
	$180,000,000		

***Recommendation*: The CSI-Thermal natural gas program incentives budget should include four declining steps (per customer class, per utility territory) that lower available incentives over the course of the program based on the amount of capacity installed. The funding is split 40% residential (10% single family and 30% multifamily) and about 60% commercial.**

4.9.3 Incentive Budget for Electric Displacing SWH Systems

As noted earlier, incentives for electric-displacing SWH will be funded by the CSI $100.8 million set-aside for non-PV electricity displacing technologies. Incentive budgets and incentive levels will differ from the natural gas-displacing portion of the CSI-Thermal program.

For the electric displacing program, we propose that a maximum of 80% of the potential $100.8 M in funding be set aside for non-residential projects, or $80.6 M of the total. We do not put a cap on the amount of residential projects that can be supported for the program. If the number of residential projects exceeds 20% of the program total, that

will be allowed. Unlike the natural-gas portion of the program (and unlike the general market CSI PV program), the electric-displacing solar thermal program will not have specific budget buckets designated for Residential vs. Multifamily/Commercial. Instead, there will be a cap of 80% on program participation from the multifamily/commercial sector.

Recommendation: The budget for electric-displacing solar thermal systems will not be specifically designated for Residential vs. Multifamily/Commercial. Instead, there will be a cap of 80% on program participation from the multifamily and commercial sectors.

4.10 Incentives Levels for CSI-Thermal Program

4.10.1 Performance-based Incentives

Similar to the CSI Program, we propose basing incentives for qualifying SWH systems on the expected performance of those systems. SWH systems vary significantly in price as well as in energy displacement, with more expensive SWH systems generally displacing more energy. In order to provide incentives for SWH owners to invest in more efficient systems, Energy Division recommends using expected first-year therm displacement (based on the SRCC rating) to calculate CSI-Thermal incentives. This will give system owners an incentive to invest in the most efficient systems and it will compensate them for the higher cost of doing so.

Recommendation: Incentives for both the natural gas and electric-displacing portions of the program should be based on system performance, with actual incentive amounts proportional to first-year annual energy displacement.

4.10.2 Incentives for SWH Systems that Displace Natural Gas

Energy Division proposes that the incentive scheme for the natural gas component of the CSI-Thermal Program be structured on incentive steps that decline based upon the number and expected therm displacement of participating SWH systems. Energy Division recommends that an incentive calculator be used to determine the specific incentive amount that any individual project is eligible for.

Though Energy Division's proposal is based upon the annual therm displacement of any given SWH system, it is designed so that the average small SWH system will be eligible for incentives of $1,500 through $600, depending on the incentive step when the project is completed. This means that most SWH systems installed on single-family homes will receive an incentive close to $1,500 in the first incentive step, though the actual incentive amount will be derived by multiplying the SWH system's SRCC rating by the incentive rate (Section 4.11 below on the Incentive Calculation process). For larger SWH systems, the incentive will also be calculated by multiplying the applicable incentive rate by the estimated therm displacement of the SWH system. Table 16 provides an overview of the incentive structure for each customer class.

Table 16: Proposed CSI-Thermal Program Natural Gas Displacing Incentive Structure

Step	Incentive for average SWH system	Funding amount ($1,000s)	Incentive per annual therm displaced	Estimated SWH System Equivalents
1	$1,500	$30,000	$12.82	20,000
2	$1,200	$50,000	$10.26	41,667
3	$900	$60,000	$7.69	66,667
4	$600	$40,000	$5.13	66,667

Energy Division uses $1,500 as the starting point for the incentive structure because it represents roughly 30% of the installed cost for the average residential system[37]. We believe this incentive is large enough to influence behavior without overpaying. For reference, SGIP solar PV incentives covered roughly 50% of upfront costs at the program's inception, and following incentive declines now cover about 30%. Incentives under the Emerging Renewables Program cover roughly 30% as well, and the CSI-PV Program residential incentives were initially designed to cover 30% of system cost.

While some customers will install SWH for reasons of environmental stewardship and self-reliance, many will view their SWH system purely as an investment. For this reason, we should consider SWH incentives in the context of financial return on investment. Table 17 shows several metrics that could be used to measure the value of an investment in a natural-gas displacing SWH system with and without incentives. For the purposes of this analysis we assumed an incentive of $1,500 on a SWH system costing $6,500 and displacing 117 Therms per year. Natural gas prices are assumed to increase at an average of 7 percent per year, the rate used by Itron in the Moderate Change scenario. For the purposes of this analysis, we consider the investment only over a 20-year period, even though the system would almost certainly continue to operate after that, and as a result, this analysis should be considered conservative.

Table 17: Return on Investment for Natural Gas-Displacing SWH

Analysis Period	Incentive	Internal Rate of Return	Net Present Value (5% discount rate)	Payback Period
20 years	No Incentive	2.99%	($ -902.62)	17 years
	$1,500 Incentive	5.39%	$147.38	13 years

Table 17 shows that the provision of a $1,500 incentive increases the Internal Rate of Return (IRR) from 2.99% to 5.39%. Typically, investment decisions are made by comparing the return on the investment with the return on a similarly risky investment. It would be very difficult to compare the risk of owning a SWH system with other potential investment, given SWH's unique attributes. For comparison purposes, however, it is

[37] The *Interim Evaluation* found an average residential SWH costs $6,500 before incentives or tax credits. This figure decreases to $4,550 after the 30% federal tax credit, of which $1,500 is slightly more than 30%.

worth considering the return on a 20-year Treasury Bond. In 2009, the yield on a 20-year Treasury Bond varied between 3.16% and 4.58%. Thus, a $1,500 incentive could increase the IRR of a SWH system such that an investor would earn a return no less than that of a 20-year T-Bond under current conditions. This is not to say that an investor would prefer a SWH to a 20-year T-Bond, given the different risk profiles and other attributes of the investments. This analysis does indicate, however, that it would not be irrational for an investor to purchase a SWH system, given the returns that are available on other uses of capital.

Moreover, the provision of a $1,500 incentive would move the net present value of the SWH investment from negative to positive at a discount rate of 5%. This means that, assuming the next best investment of a similar risk yielded a 5% return, investing in a SWH would provide positive value to the investor, and the investment should be made. This analysis indicates that the SWH incentive program is likely to see a response in the marketplace.

Energy Division proposes using the same per-therm incentive structure and level to provide incentives for each of the customer classes, even though each class will move independently of the others and each will be allocated a pre-set funding allowance. As a result, incentives will likely cover a larger portion of the cost of each collector for commercial systems than for residential systems, since commercial systems generally cost less per collector to install than residential systems. Because commercial system owners are not eligible for the Investment Tax Credit that is available to residential system owners, however, Energy Division believes this result is acceptable.

Recommendation: The incentives for natural gas displacing systems should start at $12.82/therm per annual therm displaced and decline in four steps to $5.13/therm. The various customer classes will use the same per-therm incentive levels, even though each class will decline independently of the others based on customer participation in each level.

4.10.3 Incentive Cap for Natural Gas Displacing Systems

Energy Division recommends setting an incentive cap for individual SWH projects. For the single family category of SWH systems, Energy Division recommends setting an incentive cap of 125% above the average incentive for any customer category. Energy Division chooses 125% above the average because the *Interim Evaluation* found that the highest performing type of SWH system is expected to displace 145 therms per year in a single-family sized application. In step 1, this system would be eligible for an incentive of up to $1859[38], which is equal to 125% of $1,500.

For the multi-family and commercial customer categories, Energy Division proposes to use a different methodology for calculating the incentive cap. Systems in both of these customer classes tend to be much larger than single-family systems, and it is therefore more difficult to forecast what a typical system will cost. In order to set an incentive cap

[38] 145 therms/yr x $12.82 = $1858.90

for these two customer classes, Energy Division proposes to initially set the incentive cap at $150,000 per system in Step 1. This number is somewhat arbitrary, as there is not adequate data available about these larger SWH systems costs. Once the CSI-Thermal Program has received a number of applications for large SWH systems, Energy Division recommends that the CSI-Thermal Program Administrators revisit the incentive cap.

Table 18: Maximum Incentive per System for Natural-Gas Displacing SWH

	Single-Family	Multi-Family & Commercial
Step 1	$1,875	$150,000
Step 2	$1,500	$150,000
Step 3	$1,125	$150,000
Step 4	$750	$150,000

Recommendation: The Commission should adopt an incentive cap at 125% of the average system for residential systems. The incentive level cap for multi-family and commercial systems should be revisited once there is more program data available.

4.10.4 Incentive Step-Down Process for Natural Gas Displacing Systems

Energy Division recommends that incentive declines be triggered by the expected annual therm displacement of confirmed reservations SWH system program applications for each customer class, in each service territory. In order to maximize total capacity installed, the number of therms in each step will increase as the steps progress. Table 19 shows the four incentive steps, along with the percentage of funds, total funding amount and annual therm displacement allocated to each customer class. The table also converts annual therm displacement in each step to an "equivalent number of residential SWH systems", showing that the proposed program will displace as much natural gas as 195,000 residential SWH systems. When added to the 5,000 residential SWH systems that will be funded through the low-income program, the proposed program reaches the goal of 200,000 SWH systems called for in AB 1470.[39]

Step changes will be triggered by total installed capacity measured in annual energy displacement, and steps will move independently in each service territory and for each class of customer.[40] The incentive structure step change mechanism is described in Section 4.10.4, and it will be the responsibility of the Program Administrator's to ensure market understanding and knowledge of the currently applicable incentive level.[41]

[39] As noted elsewhere, this staff proposal assumes that the AB 1470 goal of 200,000 systems is really a goal of "200,000" residential systems, and so therefore the goal needs to be normalized for the fact that larger multifamily or commercial systems displace more therms than residential systems.

[41] As an analogy, the CSI Program Administrator's currently maintain the CSI Trigger Tracker website: www.csi-trigger.com.

As shown in Table 19, the total incentive funding in the program is divided between customer classes as follows: 10 percent for single-family customers; 30 percent for multi-family customers; and 60 percent for commercial customers. Energy Division selected this breakdown of program funds because Itron's analysis showed that such an allocation could maximize the thermal displacement and overall benefit-cost ratio for the program.

Table 19: CSI-Thermal Program Natural Gas Displacing Incentive Structure by Customer Class

Step	Customer Class	Incentive for avg. system	Avg. Therms Displaced/year	Incentive per annual therm displacement	Percentage of funds	Funding amount ($1,000s)	Thm displacement/year (1,000s)	Equiv. # res. systems
1	Single-family	$1,500	117	$12.82	1.75%	$3,145	182	1,555
	Multi-family	$11,525	899[42]		4.98%	$8,967	689	5,969
	Commercial	$86,253	6728[43]		9.94%	$17,888	1,460	12,476
	Subtotal				*16.67%*	*$30,000*	*2,340*	*20,000*
2	Single-family	$1,200	117	$10.26	2.91%	$5,242	379	3,239
	Multi-family	$9,224	899		8.30%	$14,945	1,455	12,436
	Commercial	$69,029	6728		16.56%	$29,814	3,041	25,993
	Subtotal				*27.78%*	*$50,000*	*4,875*	*41,667*
3	Single-family	$900	117	$7.69	3.49%	$6,290	606	5,182
	Multi-family	$7,156	899		9.96%	$17,933	2,328	19,897
	Commercial	$53,555	6728		19.88%	$35,776	4,866	41,588
	Subtotal				*33.33%*	*$60,000*	*7,800*	*66,667*
4	Single family	$600	117	$5.13	2.33%	$4,194	606	5,182
	Multi family	$4,612	899		6.64%	$11,956	2,328	19,897
	Commercial	$34,515	6728		13.25%	$23,851	4,866	41,588
	Subtotal				*22.22%*	*$40,000*	*7,800*	*66,667*
	Total				**100%**	**$180,000**	**22,815**	**195,000**

<u>Recommendation</u>: Incentive declines should be triggered by the first-year therm displacement of confirmed reservations for each customer class, in each service territory. Incentive levels should be apportioned such that the program can provide incentives for the "equivalent of 200,000" residential systems, although the actual number will be a smaller number of systems, since commercial and multifamily systems displace more therms per system.

[42] The *Addendum* assumed that there are two average savings values for multi-family SWH systems, 194 therms/year for multi-family buildings with 2-4 residents, and 1,604 therms/year for larger buildings. The 899 therms/year assumes that there is a 50%-50% split between large and small multi-family SWH systems

[43] The *Addendum* assumed that there are three average savings values for commercial SWH systems: 1,381 therms/year for restaurants, 10,691therms/year for health clubs and 8,112 therms/year for lodging facilities. The 6,728 therms/year assumes that there is a 33%-33%-33% split between each of these categories

4.10.5 Incentive Levels for Electric Displacing SWH Systems

SWH systems that displace electricity are already closer to cost-effective for the system owner, and this staff proposal recommends setting the incentive at a lower level than for natural-gas displacing SWH systems.

This proposal recommends setting the incentive for electric displacing SWH at $1,000 for an average system.[44] Energy Division proposes a single fixed incentive for electric-displacing single-family SWH, rather than a series of declining incentive steps, because electric water heating is used in only about 10 percent of California homes. Due to the relatively small size of the market, reducing incentives for electric-displacing SWH is not likely to drive market transformation, and it might not be reasonable to expect SWH system cost declines to correspond to market uptake of electric-displacing systems. For these reasons, as well as for administrative simplicity, Energy Division feels a fixed incentive is an appropriate starting point for electric-displacing SWH systems.

We recommend using the same approach for calculating incentives for specific projects as used in the natural gas component of the CSI-Thermal Program, described in more detail in Section 4.11

As shown in Table 20 for each electric-displacing SWH system, a participant would receive an upfront incentive calculated by multiplying the annual energy displacement by $2,735/kWh, so that the average system receives an incentive of approximately $1000. Incentives per residential system should be capped at 125% of that value, or $1,250. Incentives for multifamily and commercial systems will be capped at $100,000, but this cap may be re-considered after the program has generated data on the average size of multi-family and commercial systems electric-displacing systems.

Table 20: Incentive Structure for Electric Displacing SWH Systems

Customer Class	Incentive for avg. system	Incentive per kWh Displaced	Avg. kWh Displaced/year	Maximum incentive	Max. Funding amount
Residential	$1,000	$0.37	2,735	$1,250	$100.8 M
Multi-family/ Commercial	N/A[45]	$0.37	N/A	$100,000	

The Commission should re-examine the incentive level for after two years and consider adjusting the incentive level based on market size and effects of the program. Because electric-displacing SWH is a very small segment of the total SWH market, and thus

[44] The *Interim Evaluation* found that an average single-family sized electric displacing SWH system displaces 2,735 kWh per year.
[45] The SWHPP has not produced enough data on multi-family/commercial electric-displacing systems to predict the electric displacement of the average system or average incentive

unlikely to drive market transformation, Energy Division presumes that a pre-determined step-down similar to what is proposed for natural-gas displacing SWH will not be necessary for the electric-displacing portion of the program.

Recommendation: Incentives for electric-displacing systems should be available at $0.37 per first-year kWh displacement and should not decline in pre-determined steps. For the average residential system, this incentive would be approximately $1,000 per system. The Commission should reconsider the incentive level after two years and consider reducing the incentive if the market is growing or prices are declining.

4.10.6 Counting Electric Displacing SWH Systems towards the CSI-PV Incentive Steps

In D.06-12-033, the Commission noted that one challenge for including non-PV solar technologies in the CSI program was the methodology to estimate the "electricity displacement" value of a technology that do not generate electricity.[46] Subsequent to the decision, the CSI Program Administrators did develop a methodology for estimating electricity displacing technologies, and using that methodology to determine how to count non-PV solar technologies against the CSI incentive step levels (also known as Trigger Tracker) and determine an incentive level to pay CSI program participants.

In Section 4.1, this proposal recommended goals for the electric displacing component of the CSI-Thermal Program. The proposal is based on converting the energy displacement rating of a SWH system into a comparable rating for an energy generator. Energy Division recommends using this same conversion to determine how electric displacing SWH systems will be counted against given CSI-PV Program incentive step level.

For example, if an electric-displacing SWH system applies to the CSI-Thermal Program in the service territory of SCE, the process for calculating that systems impact against the applicable incentive step would be the following:

An electric displacing SWH system that is rated to displace 2735 kWh per year applies to the CSI-Thermal Program.

1) The first step is to convert the energy displacement value into kW of capacity for the purposes of accounting within the CSI-PV incentive

[46] D.06-12-033, p.25-26 states, "We note that the use of certain non-PV technologies could raise unique estimation, metering and measurement issues if the technology displaces electricity but does not produce it. In comments on the Staff Proposal, parties suggested various approaches for addressing this issue, but the record lacks sufficient detail to direct a specific conversion approach for estimating or measuring electric displacement. We direct the CSI program administrators to assign or hire technical experts to address the technical details of estimating non-PV output for EPBB incentives and metering and measuring electric displacement for PBI payments. The program administrators should file CSI Handbook revisions relating to these non-PV estimation, metering, and measurement guidelines no later than April 1, 2007 or as otherwise directed by the assigned Commissioner or ALJ. The ALJ shall consult with the assigned Commissioner to review and approve these handbook revisions by ruling or Commission order, as deemed appropriate. Incentives for non-PV technologies will be available once the Commission's ruling or order accepting these revisions is issued."

structure. Dividing 2735 kWh/year by 1752 kWh/year/kW gives 1.56 kW.

2) The next step is to factor the SOF of the SWH project. In this case it is 1.0, so the SWH system would count as 1.56 kW of solar PV capacity against the CSI program step level.
3) So, if the project applies into SCE territory in Step 5, then the project will be counted as 1.56 kW towards the total capacity limit in Step 5 and tracked in CSI "Trigger Tracker" as 1.56 kW at Step 5.

However, while this staff proposal recommends a method for SWH systems to count against the Step levels in CSI; the incentive calculation would not be the currently applicable incentive level. Instead, the incentive calculation for an electric displacing SWH system would be set according to the methodology recommended in Section 4.10.5.

Recommendation: The CSI-Thermal Program should use the methodology described herein to estimate the electricity displacement associated with SWH systems and use that kW capacity value to count the systems towards the CSI steps in Trigger Tracker (and the CSI electricity related program goals.)

4.11 CSI-Thermal Program Incentive Calculator

To calculate incentives for the CSI-Thermal Program, this proposal recommends that the CSI-Thermal Program Administrators develop a simple incentive calculation tool that is available on-line to solar contractors and customers. The purpose of the tool will be to both provide an upfront estimate of the incentives available through the program based on the specific design characteristics of the installation and to calculate the incentive payment based on the actual installation. The key parameters for how the incentive calculator should be designed, including the process for calculating the expected energy displacement of a SWH system and the value of how the SWH system is oriented, are described below.

4.11.1 Incentive Calculator Tool for Estimating Energy Displacement

This proposal recommends that the CSI-Thermal Program Administrators develop an on-line incentive calculation tool. At a minimum, this tool should:

- Estimate Energy Displacement for SWH systems based upon performance of SWH system, location and system design (parameters for estimating energy displacement are included below in Sections 4.11.2 and Section 4.11.3)
- Calculate SWH Incentives
- Interface with CSI-Thermal Program Application and Database
- Allow the CSI-Thermal Program Administrators to collect information about expected performance of SWH installations that the Evaluation program can use after the fact to compare actual system performance with expected performance.

The most critical element of the incentive calculation is estimating the amount of energy any given SWH system will displace.

Solar Rating and Certification Corporation (SRCC)[47] certifies solar collectors and they also rate the expected output of the equipment. SRCC has two different ways of rating expected performance depending on the size of the SWH system:

- **The OG-300 rating**[48] applies to the total expected performance of a SWH system, taking into account the expected performance of solar collectors and the balance of system, including pumps, heat exchangers and storage tanks. In addition, the OG-300 rating also takes into account location, which in California means every system has a different OG-300 rating in each of the state's 16 climate zones.
- **The OG-100 rating**[49] applies only to the solar collector and provides an estimate for how much thermal energy a solar collector may produce. Unlike the OG-300 rating, OG-100 rated SWH systems do not take into account how the balance of system performs, and so it does not estimate the total amount of energy the system may displace.

Because of the differences between the OG-100 and OG-300 SWH systems, Energy Division recommends developing two methodologies for estimating SWH system performance in the CSI-Thermal Program.

- The first methodology will apply to OG-300 rated systems and will simply be based on the SRCC annual energy displacement rating.
- The second methodology will apply to OG-100 rated SWH systems and will be based upon a widely used and accepted approach to estimating the amount of energy a SWH system will displace.

Energy Division believes this methodology is fair to the customer and ratepayer because it establishes incentives based on the expected performance of the installed system. It is easy to use for the solar thermal contractor because he/she simply enters a few system

[47] SRCC is a non-profit organization whose primary purpose is the development and implementation of certification programs and national rating standards for solar energy equipment. The corporation is an independent third-party certification entity, the only national certification program established solely for solar energy products, and the only national certification organization whose programs are the direct result of combined efforts of state organizations involved in the administration of standards and an industry association. SRCC currently administers a certification, rating, and labeling program for solar collectors and a similar program for complete solar water heating systems. SRCC's certification program operating guidelines, test methods and minimum standards, and rating methodologies require the performance of nationally accepted equipment tests on solar equipment by independent laboratories which are accredited by SRCC. The test results and product data are evaluated by SRCC to determine the product's compliance with the minimum standards for certification and to calculate the performance ratings. Equipment which has been certified and rated by SRCC is required to bear the SRCC certification label which shows the performance rating for that product. In addition, each certified product is published by SRCC in a directory. Each product's directory listing contains information on the product's material and specifications as well as the certified thermal performance rating. See http://www.solar-rating.org/ for more information.

[48] SRCC OG-300 Rating

[49] SRCC OG-100 Rating

parameters to an online template, and the solar savings and solar fraction are immediately calculated. It also encourages more professional development in the solar industry.

Recommendation: The CSI-Thermal Program Administrators should develop an on-line incentive calculation tool to estimate energy (natural gas or electricity) displacement for SWH systems based upon expected performance of SWH system, location and system design.

4.11.2 Calculating Incentives for SRCC OG-300 Systems

For SRCC OG-300 SWH systems, Energy Division recommends using the SRCC estimation of annual energy savings combined with the Solar Orientation Factor (SOF), which is calculated by measuring the tilt and azimuth of the SWH installation. Table 21 can be used to determine the applicable SOF for a given SWH installation.

Table 21: Solar Orientation Factor Table

Azimuth	Tilt	SOF
160 – 200 True 201 – 225 True	10 – 50	1.0
135 – 159 True 226 – 270 True	10 – 50 10 – 30	0.95
90 – 134 True 226 – 270 True	10 – 30 30 – 50	0.90
90 – 134 True 135 – 225 True	30 – 50 50 – 70	0.85

Source: NREL Solar Orientation Chart

To calculate an incentive, Energy Division proposes the following formula:

*SRCC annual energy savings * Incentive per them or kWh * SOF = total incentive*

As an example, an OG-300 SWH system that is rated to displace 117 therms per year and that has a SOF of 0.95 would be eligible for an incentive of $1140 in Step 2.

117 therms/yr x $10.26 (incentive in Step 2) x 0.95 SOF = $1140

Recommendation: To calculate the incentive for SRCC OG-300 SWH systems, Energy Division recommends using the SRCC estimation of annual energy savings combined with the Solar Orientation Factor (SOF), which is calculated by measuring the tilt and azimuth of the SWH installation.

4.11.3 Calculating Incentives for SRCC-OG 100 Systems

Energy Division recommends establishing the incentive for OG-100 rated SWH systems by estimating annual savings for each custom designed system. This can be done for

most types of systems by running either FCHART program, or the more sophisticated TRNSYS program[50]. These programs are flexible and produce an estimated annual savings values in terms of either annual therms or kWh displaced. These tools account for the performance of the solar collectors, the balance of system equipment and the location of the SWH system.

In order to provide a simplified and user-friendly tool for calculating the estimated energy displacement of OG-100 rated SWH systems, Energy Division recommends that the CSI-Thermal Program Administrators build and/or license an internet-based incentive calculation tool that uses either FCHART or TRNSYS as its SWH system production estimation engine.

- For SRCC OG-100 SWH systems, Energy Division recommends using the production estimator that will be developed by the program administrators, as described above. This tool would take into account the SRCC rating of the solar collector and then use a widely accepted estimation tool like FCHART or TRNSYS, to calculate the expected performance of the SWH system.

To calculate an incentive, Energy Division proposes the following formula:

> *Annual energy savings (from CSI-Thermal Program estimation tool) * incentive per therm or kWh * SOF = Total Incentive*

As an example, an OG-100 SWH system's design characteristics and solar collector rating is entered into the CSI-Thermal Program's estimation tool. The result is a SWH system that is rated to displace 300 therms per year. This SWH system also has a SOF of 1.0, and so would be eligible for an incentive of $3,078 in Step 2.

> *300 therms/yr x $10.26 (incentive in Step 2) x 1.0 SOF = $3,078*

Recommendation: Energy Division recommends establishing the incentive for SRCC OG-100 SWH systems by using currently available tools for estimating annual savings for each custom designed system.

4.12 CSI-Thermal Low Income Single-family Program

This proposal recommends allocating up to $20 million of CSI-Thermal Program incentives for natural gas displacing systems on eligible low income single-family properties. The proposal recommends that the CSI-Thermal Program should not have a low-income portion for electric-displacing SWH systems, due to the relatively low penetration of electric water heating in California.

4.12.1 CSI-Thermal Natural-Gas Displacing SWH Low-Income Incentive Budget

[50] F-Chart and TRNSYS are software applications that calculate solar thermal output using various design parameters of each individual system

Energy Division recommends setting aside an incentive budget of $20 million for a low-income component of the CSI-Thermal Program. Energy Division proposes that the CSI-Thermal Program Administrators also administer the CSI-Thermal incentives for low-income participants, and that the program launch simultaneous with the other portions of the program. Incentives provided via this $20 million fund will be available only to income-qualified low-income participants installing SWH systems that displace natural gas, since this program will be funded only by natural gas ratepayers. Energy Division recommends extending low-income incentives only to single-family customers, since a significant portion of residents (about 30 percent) in multi-family buildings do not pay for water heating.[51]

The goal of the low-income portion of the program will be to install 5,000 systems on qualified low income participant households. The incentive level for low-income participants will be twice the currently applicable incentive level for program participants. We recommend setting the incentive at this level to compensate for the fact that low-income customers may not have tax liability and thus may not be able to take advantage of the 30% investment tax credit.

The SASH program offers incentives at a declining rate, based on the total income level of the participant. Likewise, the CSI-Thermal Program will decline its incentives, through the four steps as described in Section 4.10.4. The only difference will be that low-income program participants will always be eligible for 200% for the incentive level, and that the budget for low-income program participation will be capped at $20 million.

The low-income component of the CSI-Thermal Program should be coordinated to the extent possible with the low-income programs of the CSI-PV Program, known as the Multifamily Affordable Solar Housing (MASH) and the Single-family Affordable Solar Homes Program (SASH). The Commission may consider modifying MASH and SASH in the future to offer incentives to SWH that displace electricity on eligible low-income properties.

Table 22: Low Income Incentive Budget for Natural Gas Displacing Systems

Incentive step	**Funding amount**		
Program Administrator	**SCG**	**PG&E**	**CCSE (SDG&E)**
Incentives for Low-Income Participants with Natural Gas Displacing SWH Systems	$10,200,000	$7,800,000	$2,000,000
TOTAL	**$20,000,000**		
Estimated Annual Therm Displacement	**585,000**		
Goal/ Estimated Number of Residential Systems to be Funded	**5,000**		

[51] KEMA Inc, "Final Report on Phase 2 Low Income Needs Assessment," September 7, 2007.

Recommendation: The CSI-Thermal Program should have a set-aside budget of $20 million, and it should fund qualified low-income single-family homeowners that install gas displacing SWH systems. The incentive level for the low-income portion of the CSI-Thermal program should be 200% of the currently applicable incentive level.

4.12.2 Participant Eligibility for CSI-Thermal Low-Income Program

The Energy Division recommends that the CSI-Thermal Low-Income Program be available for low-income customers that have already participated in the Low Income Energy Efficiency (LIEE) program, and that meet all other income and housing eligibility guidelines for the SASH program, including:

- The residence must be occupied by the homeowner who applies for an incentive.
- The household's total income must be 80% of the area median income (AMI) or less based on the most recent available income tax return.
    - Area Median Income is subject to annual changes based upon Housing and Urban Development's income guidelines.
- The residence must be California Public Utilities Code (P.U.) 2852-compliant, defined as:
    - A single family residence that is part of a two or more-unit development project; and
    - Twenty percent of the homes are sold to lower income households (as defined in Health and Safety Code Section 50079.5); and
    - Those units targeted for lower-income households are subject to a deed restriction or covenant with a public entity, ensuring that the units will be available at an affordable housing cost (as defined in Health and Safety Code Section 50052.5).

Recommendation: The low-income portion of the CSI-Thermal Program should have participant eligibility requirements analogous to the SASH program.

4.13 CSI-Thermal Program Handbook

Energy Division recommends the CSI-Thermal Program Administrators develop and submit to the Commission for approval a detailed CSI-Thermal Program Handbook that establishes the detailed rules and requirements for participating in the program.

4.13.1.1 CSI-Thermal Program Handbook Process

Initially, the CSI-Thermal Program Handbook should be submitted by the Program Administrators via Advice Letter within 30 days of the effective date of any Commission decision authorizing this program. The first version of the CSI-Thermal Program Handbook should be accepted (i.e. put in effect) via Administrative Law Judge (ALJ) ruling. If there are any Program Handbook issues that require public comment and

Commission decision, the ALJ should determine the appropriate process for incorporating stakeholder comment into the inaugural CSI-Thermal Program Handbook approval process.

Subsequent modifications to the CSI-Thermal Program Handbook should be made via Advice Letter and approved by Energy Division. Energy Division should be delegated the authority to approve program modifications that are consistent with Commission decision. Modifications to the program that stem from Commission decision will require a Petition to Modify, consistent with Commission Rules of Practice and Procedure.

The CSI-Thermal Program Handbook should be developed initially using a public, stakeholder-inclusive process led by the Program Administrators. Energy Division recommends that the Program Administrators convene a stakeholder process that includes the Energy Division, the California Energy Commission, the technical experts available (potentially the Technical Advisory Committee of the SWHPP) and other stakeholders.

The CSI-Thermal Program Administrators should conduct a quarterly stakeholder meeting, in conjunction or simultaneous with the CSI Program's existing Program Forum, to review stakeholder suggestions and requests for ongoing program modification suggestions.

Recommendation: The CSI-Thermal Program Administrators should use a public process to develop a CSI-Thermal Program Handbook. The Handbook should be submitted to the Commission via a motion to be accepted by ALJ Ruling. Subsequently, the Program Administrators should host quarterly meetings with stakeholders to entertain program modification suggestions. The Program Administrators should submit Program Handbook modifications to the Energy Division via Advice Letter.

4.13.2 CSI-Thermal Handbook and Modifications to the CSI Program Handbook

The CSI-Thermal Program Handbook should serve as the central repository for all program rules and requirements related to funding solar thermal incentives. This may require changing the existing CSI-PV Program Handbook, which is currently written to allow some non-SWH, non-PV solar thermal electric displacing technologies to receive incentives. These changes may include modifications to non-PV CSI program requirements such as metering and incentive calculation protocols. Alternatively, all non-PV CSI aspects may be housed in the CSI-Thermal Program Handbook.

Recommendation: The CSI-Thermal Program Handbook must be reconciled with the current CSI Program Handbook.

4.13.3 CSI-Thermal Program Requirements Addressed in Program Handbook

Energy Division recommends addressing all incentive program requirements – including the application process, minimum equipment eligibility standards, incentive calculation, program administration rules, and energy efficiency requirements – in the CSI-Thermal Program Handbook. The CSI-Thermal Program Handbook will include both the general market program as well as the low-income program.

The minimum eligibility requirements included in AB 1470 should be used as a starting point for the CSI-Thermal Program Handbook:

- Single-family SWH systems must be SRCC OG-300 certified, while multi-family and commercial systems must be SRCC OG-100 certified *(P.U.Code Section 2864.1)*
- Participating SWH systems must be new and unused and have not been previously placed in service *(P.U.Code Section 2864.2)*
- SWH collectors must have a warranty of at least 10 years *(P.U.Code Section 2864.3)*
- Participants must be connected to natural gas distribution system *(P.U.Code Section 2864.4)*
- Meters shall be required to monitor performance for systems with a capacity for displacing over 30 kW th. Meters may be required for systems displacing less than 30 kW th *(P.U.Code Section 2864.5)*
- Participating SWH systems should be installed to conform with manufacturers specifications and all applicable codes and standards *(P.U.Code Section 2864.6)*
- Appropriate energy efficiency improvements in the new or existing home or commercial structure where the solar hot water system is installed. *(P.U.Code Section 2865.1)*
- The commission shall set rating standards for equipment, components, and systems to ensure reasonable performance and shall develop standards that provide for compliance with the minimum ratings. *(AB 1470, P.U.Code Section 2865.2(b))*

Recommendation: All incentive program requirements – including the application process, minimum equipment eligibility standards, incentive calculation, program administration rules, and energy efficiency requirements will be specified in the CSI-Thermal Program Handbook. The minimum eligibility requirements included in AB 1470 should be used as a starting point for the CSI-Thermal Program Handbook.

4.13.4 CSI-Thermal Program Handbook Outline

Where nothing is specified by AB 1470, or where AB 1470 explicitly defers to the Commission, Energy Division recommends adopting the program design parameters detailed in this staff proposal and the requirements set forth in the existing SWHPP Handbook.

To assist in the development of the CSI-Thermal Program Handbook, Energy Division recommends the adoption of the following Program Handbook outline:

1. Introduction to CSI-Thermal Program
    - 1.1 Program Background
    - 1.2 Program Budget
    - 1.3 Program Goals
    - 1.4 Incentive Structure
2. Program Eligibility Criteria and Requirements
    - 2.1 Participants in the CSI-Thermal Program
        - 2.1.1. Natural Gas Displacing SWH -- Customer
        - 2.1.2. Natural Gas Displacing SWH -- Contractor
            - 2.1.2.1. Installation Quality Assurance
            - 2.1.2.2. Insurance Requirements
        - 2.1.3. Electric Displacing SWH – Customer
        - 2.1.4. Electric Displacing SWH – Contractor
            - 2.1.4.1. Installation Quality Assurance
            - 2.1.4.2. Insurance Requirements
        - 2.1.5. Equipment Sellers
    - 2.2 Equipment Eligibility and Requirements
        - 2.2.1. Eligible Equipment
        - 2.2.2. Required Freeze and Scald Protection
        - 2.2.3. Shading
        - 2.2.4. System Sizing
        - 2.2.5. Ineligible Equipment and System Applications
    - 2.3 Warranty Requirements
    - 2.4 Metering Requirements
        - 2.4.1. Small Systems (under 30 kWth)
        - 2.4.2. Large Systems (over 30 kWth)
    - 2.5 Owner's Manual
    - 2.6 Inspection Requirements
        - 2.6.1. Failed Inspections
        - 2.6.2. Owner's Manual
3. CSI-Thermal Program Incentive Structure
    - 3.1 Natural Gas Component
        - 3.1.1. Single-Family
        - 3.1.2. Multi-Family
        - 3.1.3. Commercial
    - 3.2 Electric Component
        - 3.2.1. Single-Family
4. CSI-Thermal Program Incentive Calculator
    - 4.1 OG-300
    - 4.2 OG-100
5. Incentive Application Process for CSI-Thermal Program
    - 5.1 Requesting an Incentive Reservation
        - 5.1.1. Incentive Reservation for Third Party Purchases
    - 5.2 Incentive Reservation Approval
    - 5.3 Changes to Reservations
        - 5.3.1. Installed Equipment
        - 5.3.2. Extending the Reservation Expiration Date
    - 5.4 Incentive Payment Request Process

4.14 CSI-Thermal Market Facilitation, including Marketing and Outreach

Energy Division believes that the market growth fostered by a statewide program of up-front incentives for SWH installation combined with Market Facilitation activities will collectively contribute to reducing the up-front cost of installing SWH systems.

The *Interim Evaluation* identified numerous barriers to SWH. These barriers can be addressed by a "Market Facilitation" component of the CSI-Thermal Program.

The three major barriers identified by the *Interim Evaluation* include:

- Lack of public knowledge about SWH
  - The *Interim Evaluation* found that the public often confuses SWH with solar PV, and that there is a general lack of public understanding about SWH as a renewable energy technology that can save money and benefit the environment.
  - In addition, there is a lingering distrust of SWH resulting from the perceived "failure" of earlier solar incentive programs.
- Lack of understanding about SWH within local government building departments
  - The *Interim Evaluation* found that many SWH contractors see permitting – both the costs of the permits and the time spent getting a permit – to be the single greatest barrier to widespread installation of SWH.

- Shortage of experienced SWH installers.
    - This barrier will be particularly problematic when demand for SWH systems begins to ramp up, and there are insufficient numbers of qualified installers to meet demand.

To address the public knowledge gap, reduce the cost of obtaining a permit for SWH systems, and develop the SWH workforce, the CSI-Thermal Program will allocate up to $37.5 million for over the course of the eight-year Program to pay for activities related to Market Facilitation that can address the barriers identified above.

The Program Administrators should submit via Advice Letter to the SWH rulemaking an annual budget and activities plan that outlines their proposed activities scope, no later than October 1st of each calendar year, with a Market Facilitation plan for the subsequent calendar year. The Annual Market Facilitation Plan should include activities that address all of the barriers identified above, the barriers identified in SWH program evaluation studies, or other issues that arise in the marketplace. The Annual Market Facilitation Plan will identify any statewide coordinated activities.

The actual budget for Market Facilitation activities should be established annually via the approval of Annual Market Facilitation Plans via a Resolution. A proposed budget allocation in Table 23 is provided as a guide for the Program Administrators. The suggestion is to front load the Market Facilitation budget, such that approximately 20% of total monies are spent in years 1 and 2, while the program is getting started and tools are being developed. The program is an 8 –year program, and years 3 through 8 would have approximately 10% of the budget per year. The actual authorized funding would be determined on an annual basis upon submittal, review and approval of an Annual Market Facilitation Plan. There may be unique market opportunities or large single-time budget expenditures that warrant deviating from this proposed budget.

Table 23: Market Facilitation Proposed Budget

Budget Year			2010	2011	2012-2017
			20%	20%	10%
Natural Gas Displacing Program					
PG&E	51.00%	$12,750,000	$2,550,000	$2,550,000	$1,275,000
SCE	0.00%	$0	$0	$0	$0
CCSE	10.00%	$2,500,000	$510,000	$510,000	$255,000
SCG	39.00%	$9,750,000	$1,950,000	$1,950,000	$975,000
		$25,000,000	$5,010,000	$5,010,000	$2,505,000
Electric Displacing Program					
PG&E	43.70%	$4,370,000	$874,000	$874,000	$437,000
SCE	46.00%	$4,600,000	$920,000	$920,000	$460,000
CCSE	10.30%	$1,030,000	$0	$0	$0
SCG	0.00%	$0	$0	$0	$0
		10,000,000	$1,794,000	$1,794,000	$897,000
Combined CSI-Thermal					
PG&E		$17,120,000	$3,424,000	$3,424,000	$1,712,000
SCE		$4,600,000	$920,000	$920,000	$460,000
CCSE		$3,530,000	$510,000	$510,000	$255,000
SCG		$9,750,000	$1,950,000	$1,950,000	$975,000
Total		**$35,000,000**	**$6,804,000**	**$6,804,000**	**$3,402,000**

As noted in Section 4.6, the Market Facilitation budget will come partially from the natural gas-displacing part of the program, and partially from the electric displacing part of the program.

- For the Program Administrators that deal with both gas and electric (PG&E and CCSE), it will be appropriate to comingle Market Facilitation funds to maximize the effectiveness of program outreach.
- For the Program Administrators that deal with only gas (SCG) and/or only electric (SCE), it will be appropriate to co-fund some statewide activities that cover both gas and electric – such that there can be a uniform statewide messaging and outreach on the program.

The Program Administrators of the CSI—Thermal Program will oversee Market Facilitation activities, but they will utilize third party resources, as appropriate. The Program Administrators should coordinate on some statewide Market Facilitation activities, and other activities should be conducted on a territory-specific basis.

The Market Facilitation Plans will include, but are not limited to, activities in the following areas.

- Activities to Address Public Knowledge about SWH
    - Consumer Education and Outreach related to the CSI-Thermal program
    - Brochures, websites and other informational tools
    - Consumer decision-making tools to aid in the purchasing decision of SWH products

  - Participation in local and regional events targeted at potential SWH consumers
  - Participation in SWH trade and industry events to promote understanding of the CSI-Thermal Program
  - Information on financing SWH systems
  - Build transparency and understanding in the market
  - Proactive press, communications, or marketing & outreach strategies
- Activities to Address Lack of Knowledge about SWH among Local Building Officials
  - Training building officials and outreach on permitting of SWH
  - Encouraging local jurisdictions to adopt streamlined permitting processes and minimum appropriate fees
  - Addressing concerns of local officials with respect to system safety, including weight loading or fire safety.
- Activities to Address Shortage of Experienced SWH Installers
  - Training on the CSI-Thermal Program
  - Installer Training
  - Supporting high quality permit building inspection processes
  - Support for job training or workforce development programs related to solar hot water, such as coordination on curriculum development
- Other Market Facilitation Activities
  - Participation in equipment eligibility and standards development
  - Program Reporting targeted at consumers to learn about technology costs, choosing a solar contractor, financing, and system types
  - Support for or coordination with the development of programs related to financing solar hot water systems (working with municipalities and other entities that wish to offer up-front financing for SWH through AB 811[52] or via private loans)

Recommendation: The CSI-Thermal Program Administrators should be responsible for design and implementation of a set of Market Facilitation activities that address the leading non-financial barriers to the SWH market. The Program Administrators will submit Annual Market Facilitation Plans, with budgets, on an annual basis on October 1st.

4.15 CSI-Thermal Measurement and Evaluation

Energy Division proposes to allocate up to $15 M for the measurement and evaluation (M&E) of the CSI-Thermal Program, with $5 M funded from the electric-displacing program and $10 M funded from the gas-displacing program. The goal of the M&E efforts is to identify the effects of the program, measure the program's progress towards

[52] AB 811 (Levine, 2008) authorizes all cities and counties in California to allow homeowners to opt in to an assessment district for the purposes of financing the upfront installation costs of solar and energy efficiency improvements. This law enables property owners in a participating city or county to finance solar systems and energy efficiency upgrades via a municipal bond that can be repaid through property tax assessments over a period of 20 years.

meeting its goals, and to make recommendations on how the program can be modified to better achieve its goals.

For the purposes of conducting the M&E, the CSI-Thermal program funds will necessarily be comingled between gas and electric, so that the studies can be jointly funded by the four program administrators. The studies will be funded by the program administrator according to the budget responsibility breakdown noted in Table 24.

Table 24: Budget Allocation for M&E Studies

PG&E	48.9%
SCE	13.1%
CCSE	10.0%
SCG	27.9%

Energy Division recommends that the CSI—Thermal Program work closely with the CSI-PV Program Administrators to coordinate M&E efforts between the CSI program and the CSI-Thermal programs.

The CSI-Thermal M&E Program will consist of the following studies:

- Market Baseline Studies – The goals of the CSI-Thermal Program are to increase the size of the market, reduce installation costs, improve consumer understanding of and confidence in SWH technologies, and to grow the market for non-SWH solar thermal technologies. The market baseline studies will provide a basis for assessing program progress towards achieving those goals.
- Program Impact Evaluation – The CSI-Thermal impact evaluation will assess the impact of the program on electricity and natural gas demand, assess the number of systems installed, assess the greenhouse gas emission reductions achieved by the program, etc. The impact evaluation will collect and analyze actual performance data of installed systems, compare the performance data to the expected performance of those systems, and make that information readily and transparently available to consumers and policy makers.
- Program Process Evaluation – The purpose of the Process Evaluation will be to assess the program operations and make recommendations for improving the program's effectiveness.
- Cost-Benefit Studies – The purpose of the Cost-Benefit study will be to provide a periodic check on the costs and benefits of the program, and to evaluate the program's cost-effectiveness on an updated basis.
- Technology Evaluation – The purpose of technology evaluations will be to assess SWH, other (non-SWH) solar thermal technologies and their ability to support the state's goals for reducing energy demand.
- Market Surveys – The purpose of the market surveys will be to provide an opportunity to periodically assess the market, and how the market intervention is affecting market deployment.
- Other Evaluation Studies – The purpose of the other evaluation studies will be to serve the ongoing program management and evaluation needs. These studies will be directed to support the policy development, analysis, and refinement process that is key to effective ongoing program management.

The per-study budget, the frequency of studies, and the timeline of studies will be determined by the Energy Division. The CSI-Thermal Program's M&E studies will be conducted by the Energy Division, in close cooperation with the CSI Program Administrators. The Commission has reimbursable budget authority to conduct the CSI M&E studies related to the electric displacing portion of CSI, and the Commission may need to seek express authority to ensure that this authority is extended to the gas displacing (i.e. AB 1470) portion of the CSI-Thermal program.

The Energy Division and its contractors will host workshops to discuss the details of the M&E plan, and it will work in consultation with the Assigned Commissioner's office to release a biennial M&E budget and scoping plan which will serve as the basis for conducting M&E Studies. The M&E Studies will be made publicly available, and the results of the M&E studies will form the basis of program modifications, as necessary.

As part of their administrative budget and responsibilities, the CSI-Thermal Program Administrators will be responsible for ensuring that program participants provide the program with performance data, as necessary, to evaluate the program. If necessary, the Program Administrators should withhold incentive payments until the program participants can demonstrate that performance data can and will be provided for the purposes of program evaluation on an ongoing basis. The Program Administrators will be responsible for ensuring that there are enough systems with performance monitoring and metering installed to ensure that evaluation contractors have adequate data to assess the performance of systems. The Program Administrators will work with the evaluation contractors to select which small systems to install performance monitoring and metering on, if such data is not available.

In addition, the CSI-Thermal Program Administrators will be responsible for design and maintenance of a program database that facilitates program evaluation. The database should include all installation performance design characteristics and other application data. The database should indicate whether and how the installed SWH systems have performance monitoring. The database should include information about participants (include sector, NAICS code, and other appropriate demographic information). The database should include both electric and gas projects, although some fields may be different. The database should include low-income and non-low income programs. The database should allow for weekly public reporting of program application and installation data.

The CSI-Thermal Program Administrators will be responsible for quarterly progress reports that provide a snapshot of application and installation data, as well as other information on the implementation and administration of the program. The Program Administrators will also be responsible for submitting semi-annual expense reports on all aspects of the program budget.

<u>Recommendation</u>: The CSI-Thermal program should have a Measurement and Evaluation (M&E) program with a budget of $15 M that will assess the program and make recommendations for its improvement. The M&E program should be based on a plan that will be detailed by the Energy Division at a later date, but the

general scope of which is included herein. The CSI-Thermal Program Administrators are responsible for maintaining a database and conducting some public reporting.

5. Questions for Parties

1) Do you agree with the Staff Proposal's conclusions on SWH cost-effectiveness?

2) Do you agree that the CPUC should move forward with a SWH program?

3) Do you agree with the Program Design recommendations in the Staff Proposal? Please comment on the program design section in the order of the document, and identify each section by number.

   Some specific Program Design section questions include:

   (a) Should incentives be available for non-water-heating solar thermal technologies that displace natural gas? If so, should these incentives be capped on the natural gas side? (Section 4.4)
   (b) Should electric-displacing incentives from the CSI fund be counted against the step the CSI PA is in when the incentives are disbursed, or should they all be taken out of the last step (or by some other method)? (Section 4.4.3)
   (c) Should incentives for electric-displacing systems be set at the current CSI step level, or should we set them at a different level? Should the incentives decline or remain static? (Section 4.10.4)
   (d) Should monitoring equipment be required on all non-residential SWH systems, or should we select a minimum size above which monitoring would be required? If we select a minimum size, what should that size be? (Section 4.4.1)
   (e) Should we remove the cap on the incentives offered per system under the natural-gas displacing portion of the program? (Section 4.10.2)
   (f) Should we keep separate funding buckets for incentives to single-family and multi-family customers, or should we create one funding bucket for all residential customers? (See Section 4.9.2)
   (g) Electric displacing SWH systems on new homes are not covered under this proposal, and not currently covered by NSHP – should the Commission seek to address this?
   (h) Should we create a separate low-income incentive program for electric-displacing systems that displace electricity?
   (i) Should we provide extend low-income incentives to multi-family SWH systems that displace natural gas?

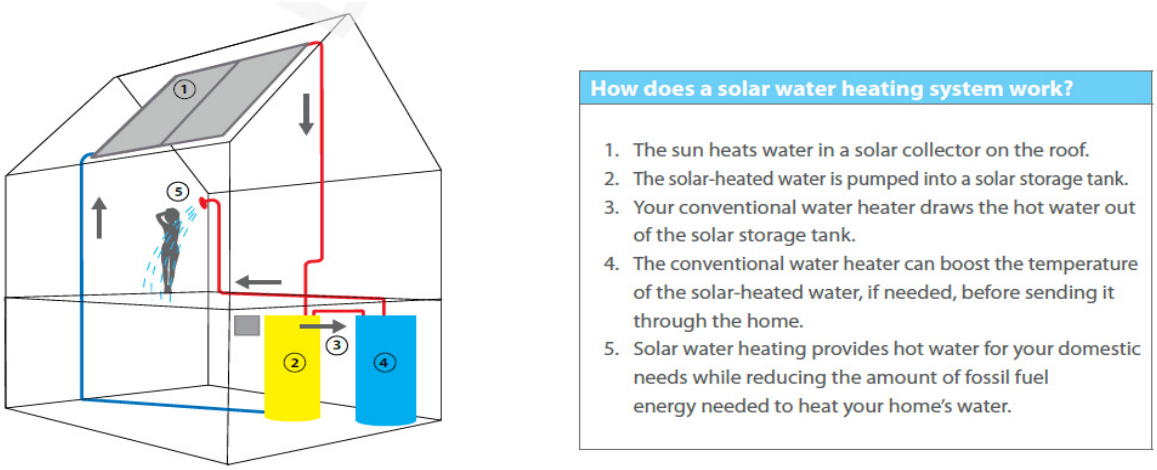
4) Should the Staff Proposal be modified to put more emphasis on removing the barriers to SWH technologies, and/or drive down the costs of the technology? If so, how?
5) Should a portion of the budget for the natural-gas displacing portion of the program be set aside to provide funds for Research and Development (R&D), in

the expectation that a R&D program could help reduce the barriers to SWH technology? (See Section 4.6)

6. Appendix A: Overview of SWH Technology

SWH systems use radiant heat from the sun to heat either water or a heat-transfer fluid in the collector. Most solar water-heating systems have two main parts: a solar collector and a storage tank. Collectors include flat-plate or evacuated tubes (seen in Figure 2). The most common collector is called a flat-plate collector. Mounted on the roof, it consists of a thin, flat, rectangular box with a transparent cover that faces the sun. Small tubes run through the box and carry the fluid — either water or other fluid, such as an antifreeze solution — to be heated. The tubes are attached to an absorber plate, which is painted black to absorb the heat. As heat builds up in the collector, it heats the fluid passing through the tubes. The storage tank holds the hot liquid. It can be just a modified water heater, but it is usually larger and very well-insulated. Systems that use fluids other than water usually heat the water by passing it through a coil of tubing in the tank, which is full of hot fluid. Solar water heating systems can be either active (with a pump) or passive (without a pump). Typically, conventional electric or natural gas powered heating elements provide additional heating as necessary.

Figure 1: How Does a SWH System Work?



The most common system in the SWHPP is the two-tank active, closed loop system (Figure 3) with propylene glycol antifreeze used as the heat exchange fluid. The other most common types of SWH systems are listed in Table 25 with their performance characteristics and median cost.

Table 25: Performance Characteristics and Costs

SWH System Type	SRCC Therm Savings	Median Installation Cost
Active Closed Loop (Glycol Active)	118	$6,586
Active Closed Loop (Drainback -- Water)	145	$7,351
Integrated Collector and Storage	96	$5,600
Thermosyphon	112	$6,750

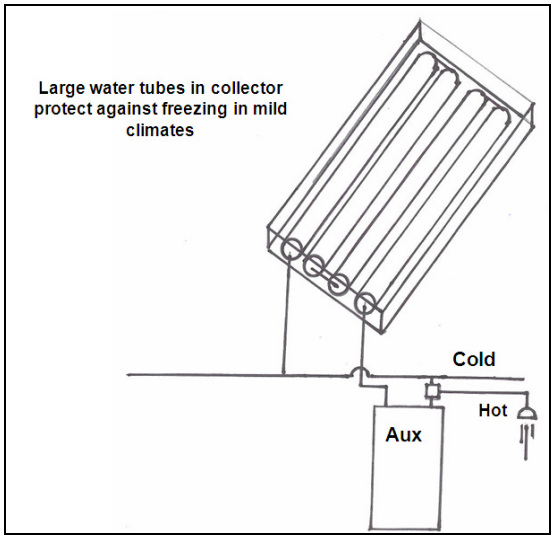
Source: *Interim Evaluation, p.15*

Figure 2: Two most common solar collectors

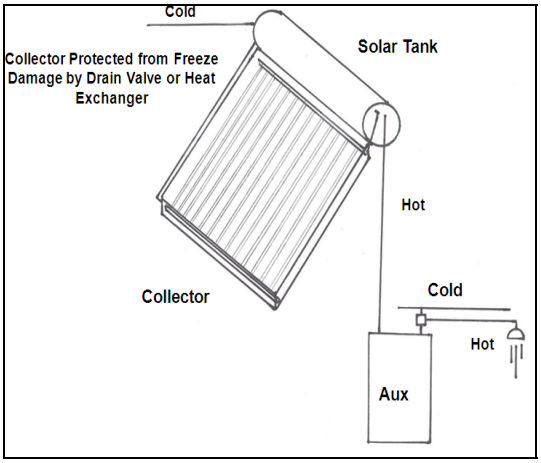
Glazed Flat-Plate Collector

Evacuated Tube Collector

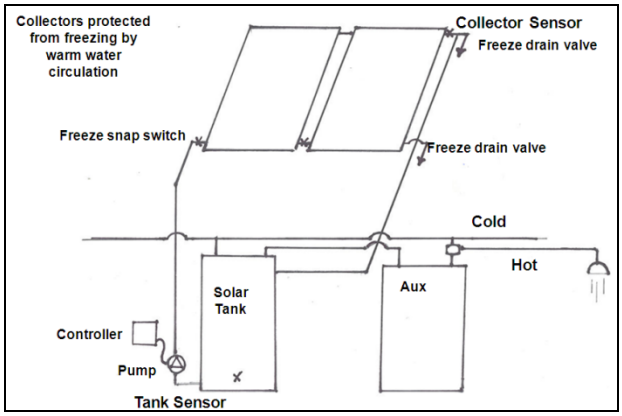
Figure 3: Four most common types of SWH systems



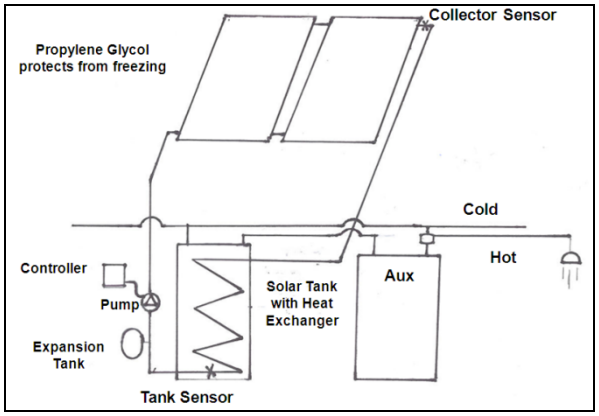
Integrated Collector and Storage



Thermosyphon



Active Open Loop



Active Closed Loop

Table 26: SWH System Descriptions

SWH System Type	How It Works
Active Closed Loop (Glycol)	The temperature sensors detect when there is solar heat gain by comparing the temperature in the solar storage tank to the temperature at the collector. When the temperature at the collector is greater than the temperature at the solar storage tank, there is an opportunity for solar energy gain. Through a controller, the pump is turned on to move the fluid through the collectors. The fluid then moves through a heat exchanger at the solar storage tank. The water inside the solar storage tank captures the heat from the fluid in the heat exchanger, raising the temperature of the water in the solar storage tank. When there is a hot water draw from the building, the water is pulled from the conventional water heater or boiler and replaced by the solar pre-heated water from the solar storage tank. This movement brings cold water into the solar storage tank, again activating the cycle of pumping the fluid through the solar collector and heat exchanger to take advantage of solar energy to heat the water
Integrated Collector and Storage	ICS systems typically hold 40-60 gallons of water within an integrated collector and storage unit located on the roof. It is a passive system with no pump. Hot water use in the building draws water from the conventional water heater. Preheated water from the ICS unit is then pulled into the conventional heater, and replaced by cold water from the city supply. The unit is constructed of a metal casing, insulation, large copper tubes and a glass glazing. The 40-60 gallons held in the large copper tubes under the glass glazing is heated by the sun, providing pre-heated water to the conventional water heater.
Thermosyphon	A thermosyphon system is a passive system with no pump. The solar storage tank is located above the collectors. In older systems, the collectors contained water in an open loop with the tank. In modern systems, the collectors contain propylene glycol in a closed loop. The glycol at the bottom of the collectors is heated and rises to the top of the collectors. At the top of the collectors, in the tank, is a heat exchanger. The heated glycol enters the heat exchanger and passes the heat to the water in the tank. The cooled glycol then flows down to the bottom of the collector. The cycling of the glycol is passively controlled by the temperature differential between the ambient air and the water in the storage tank. When there is a hot water draw in the building, water is pulled from the conventional water heater. Solar pre-heated water from the solar storage tank on the roof is then moved into the conventional water heater and cold water from the city supply flows into the storage tank. The replacement of the solar heated water with cold water in the storage tank creates a temperature differential between the heated glycol and the storage water and thus activates the passive cycling of the glycol in the collector.
Active Open Loop (water)	The temperature sensors detect when there is solar heat gain by comparing the temperature in the solar storage tank to the temperature at the collector. When the temperature at the collector is greater than the temperature at the solar storage tank, there is an opportunity for solar energy gain. Through a controller, the pump is turned on to move the water through the collectors. The water then moves into the solar storage tank. When there is a hot water draw from the building, the water is pulled from the conventional water heater or boiler and replaced by the solar pre-heated water from the solar storage tank. This movement brings cold water into the solar storage tank, again activating the cycle of pumping the water through the solar collector to take advantage of solar energy to heat the water.

7. Appendix B: Text of AB 1470

BILL TEXT

CHAPTER 536
FILED WITH SECRETARY OF STATE OCTOBER 12, 2007
APPROVED BY GOVERNOR OCTOBER 12, 2007
PASSED THE SENATE SEPTEMBER 10, 2007
PASSED THE ASSEMBLY SEPTEMBER 12, 2007
AMENDED IN SENATE SEPTEMBER 5, 2007
AMENDED IN SENATE AUGUST 31, 2007
AMENDED IN SENATE JULY 10, 2007
AMENDED IN SENATE JUNE 26, 2007
AMENDED IN ASSEMBLY JUNE 1, 2007
AMENDED IN ASSEMBLY MAY 2, 2007
AMENDED IN ASSEMBLY APRIL 12, 2007

INTRODUCED BY Assembly Member Huffman
(Principal coauthor: Assembly Member Leno)
(Coauthors: Assembly Members Beall, Carter, DeSaulnier, Krekorian, Laird, Wolk, and Saldana)
(Coauthors: Senators Corbett, Florez, Kuehl, Romero, Scott, and Wiggins)

FEBRUARY 23, 2007

An act to add the heading of Article 1 (commencing with Section 2851) to, and to add and repeal Article 2 (commencing with Section 2860) of, Chapter 9 of Part 2 of Division 1 of, the Public Utilities Code, relating to solar energy.

LEGISLATIVE COUNSEL'S DIGEST

AB 1470, Huffman. Solar energy: Solar Water Heating and Efficiency Act of 2007.

(1) Under existing law, the Public Utilities Commission has regulatory authority over public utilities, including gas corporations. The commission is required to implement elements of the California Solar Initiative, which modifies the self-generation incentive program for distributed generation resources and provides incentives to customer-side photovoltaics and solar thermal electric projects under one megawatt. The commission is required to award monetary incentives for up to the first megawatt of alternating current generated by solar energy systems that meet the eligibility criteria established by the State Energy Resources Conservation and Development Commission (Energy Commission). The commission is required to adopt a performance-based incentive program for solar energy photovoltaic systems and is authorized to award monetary incentives for solar thermal and solar water heating devices in a total amount up to $100,800,000.

This bill would establish the Solar Water Heating and Efficiency

Act of 2007. The bill would make findings and declarations of the Legislature relating to the promotion of solar water heating systems and other technologies that reduce natural gas demand. The bill would define several terms for purposes of the act. The bill would require the commission to evaluate the data available from a specified pilot program, and, if it makes a specified determination, to design and implement a program of incentives for the installation of 200,000 solar water heating systems in homes and businesses throughout the state by 2017.

The bill would require the commission, in consultation with the Energy Commission and interested members of the public, to establish eligibility criteria for the solar water heating systems receiving gas customer funded incentives. The commission would be required to establish conditions on those incentives. The bill would specify that, except for the Solar Water Heating Pilot Program in San Diego, only solar water heating technologies that displace electricity are eligible for a portion of California Solar Initiative funds, as determined by the commission.

The commission would be required to allocate not less than 10% of the overall funds for installation of solar water heating systems for specified low-income residential housing . The bill would extend eligibility for funding pursuant to this program to include residential housing occupied by specified ratepayers. The bill would specify that no moneys be diverted from any existing programs for low-income ratepayers. The bill would specify that the consumer rebates decline over time and be structured to reduce the cost of solar water heating technologies. The Energy Commission, in coordination with the commission, would be required to consider, when appropriate, coupling rebates for solar water heating systems with complementary energy efficient technologies. The commission would be required to report to the Legislature, not later than July 1, 2010, on the effectiveness of the program. The bill would repeal these provisions on August 1, 2018.

(2) Existing law establishes a surcharge on all natural gas consumed in the state to fund certain low-income assistance programs, cost-effective energy efficiency and conservation activities, and public interest research and development. Existing law requires a public utility gas corporation, as defined, to collect the surcharge from natural gas consumers, as specified. The moneys from the surcharge are deposited in the Gas Consumption Surcharge Fund and are continuously appropriated to specified entities, including to the commission, or to an entity designated by the commission, to fund low-income assistance programs, cost-effective energy efficiency and conservation activities, and public interest research and development not adequately provided by the competitive and regulated markets.

This bill would require the commission to fund the program of the Solar Water Heating and Efficiency Act of 2007, for the service territories of the gas corporations, through a surcharge applied to gas customers in those service territories based on the amount of natural gas consumed, not to exceed $250,000,000 over the course of the 10-year program. The bill would require the commission to annually establish a surcharge rate for each class of gas customers. The bill would exempt from that surcharge those gas customers participating in the California Alternate Rates for Energy (CARE) or Family Electric Rate Assistance (FERA) programs. The bill would require that the program be administered by the gas corporations or 3rd party administrators, as determined by the commission, and subject to the supervision of the commission.

(3) The bill would require the governing body of each publicly owned utility providing gas service to retail end-use gas customers, to adopt, implement, and finance a solar water heating system incentive program meeting certain requirements, thereby imposing a state-mandated local program.

(4) The California Constitution requires the state to reimburse local agencies and school districts for certain costs mandated by the state. Statutory provisions establish procedures for making that reimbursement.

This bill would provide that no reimbursement is required by this act for a specified reason.

THE PEOPLE OF THE STATE OF CALIFORNIA DO ENACT AS FOLLOWS:

SECTION 1. The heading of Article 1 (commencing with Section 2851) is added to Chapter 9 of Part 2 of Division 1 of the Public Utilities Code, to read:

Article 1. Solar Energy Systems

SEC. 2. Article 2 (commencing with Section 2860) is added to Chapter 9 of Part 2 of Division 1 of the Public Utilities Code, to read:

Article 2. Solar Water Heating Systems

2860. This article shall be known, and may be cited, as the Solar Water Heating and Efficiency Act of 2007.

2861. As used in this article, the following terms have the following meanings:

(a) "Energy Commission" means the State Energy Resources Conservation and Development Commission.

(b) "Gas customer" includes both "core" and "noncore" customers, as those terms are used in Chapter 2.2 (commencing with Section 328) of Part 1, that receive retail end-use gas service within the service territory of a gas corporation.

(c) "kWth" means the kilowatt thermal capacity of a solar water heating system, measured consistent with the standard established by the SRCC.

(d) "kWhth" means kilowatthours thermal as measured by the number of kilowatts thermal generated, or displaced, in an hour.

(e) "Low-income residential housing" means either of the following:

(1) Residential housing financed with low-income housing tax credits, tax-exempt mortgage revenue bonds, general obligation bonds, or local, state, or federal loans or grants, and for which the rents of the occupants who are lower income households, as defined in Section 50079.5 of the Health and Safety Code, do not exceed those prescribed by deed restrictions or regulatory agreements pursuant to the terms of the financing or financial assistance.

(2) A residential complex in which at least 20 percent of the total units are sold or rented to lower income households, as defined in Section 50079.5 of the Health and Safety Code, and the housing units targeted for lower income households are subject to a deed

restriction or affordability covenant with a public entity that ensures that the units will be available at an affordable housing cost meeting the requirements of Section 50052.5 of the Health and Safety Code, or at an affordable rent meeting the requirements of Section 50053 of the Health and Safety Code, for a period of not less than 30 years.

(f) "New Solar Homes Partnership" means the 10-year program, administered by the Energy Commission, encouraging solar energy systems in new home construction.

(g) "Solar heating collector" means a device that is used to collect or capture heat from the sun and that is generally, but need not be, located on a roof.

(h) "Solar water heating system" means a solar energy device that has the primary purpose of reducing demand for natural gas through water heating, space heating, or other methods of capturing energy from the sun to reduce natural gas consumption in a home, business, or any building receiving natural gas that is subject to the surcharge established pursuant to Section 2860, or exempt from the surcharge pursuant to subdivision (c) of Section 2863, and that meets or exceeds the eligibility criteria established pursuant to Section 2864. "Solar water heating systems" do not include solar pool heating systems.

(i) "SRCC" means the Solar Rating and Certification Corporation.

2862. The Legislature finds and declares all of the following:

(a) California is heavily dependent on natural gas, importing more than 80 percent of the natural gas it consumes.

(b) Rising worldwide demand for natural gas and a shrinking supply create rising and unstable prices that can harm California consumers and the economy.

(c) Natural gas is a fossil fuel and a major source of global warming pollution and the pollutants that cause air pollution, including smog.

(d) California's growing population and economy will put a strain on energy supplies and threaten the ability of the state to meet its global warming goals unless specific steps are taken to reduce demand and generate energy cleanly and efficiently.

(e) Water heating for domestic and industrial use relies almost entirely on natural gas and accounts for a significant percentage of the state's natural gas consumption.

(f) Solar water heating systems represent the largest untapped natural gas saving potential remaining in California.

(g) In addition to financial and energy savings, solar water heating systems can help protect against future gas and electricity shortages and reduce our dependence on foreign sources of energy.

(h) Solar water heating systems can also help preserve the environment and protect public health by reducing air pollution, including carbon dioxide, a leading global warming gas, and nitrogen oxide, a precursor to smog.

(i) Growing demand for these technologies will create jobs in California as well as promote greater energy independence, protect consumers from rising energy costs and result in cleaner air.

(j) It is in the interest of the State of California to promote solar water heating systems and other technologies that directly reduce demand for natural gas in homes and businesses.

(k) It is the intent of the Legislature to build a mainstream market for solar water heating systems that directly reduces demand for natural gas in homes, businesses, and government buildings. Toward that end, it is the goal of this article to install at least

200,000 solar water heating systems on homes, businesses, and government buildings throughout the state by 2017, thereby lowering prices and creating a self-sufficient market that will sustain itself beyond the life of this program.

(l) It is the intent of the Legislature that the solar water heating system incentives created by the act should be a cost-effective investment by gas customers. Gas customers will recoup the cost of their investment through lower prices as a result of avoiding purchases of natural gas, and benefit from additional system stability and pollution reduction benefits.

2863. (a) The commission shall evaluate the data available from the Solar Water Heating Pilot Project conducted by the California Center for Sustainable Energy. If, after a public hearing, the commission determines that a solar water heating program is cost effective for ratepayers and in the public interest, the commission shall do all of the following:

(1) Design and implement a program applicable to the service territories of a gas corporation, to achieve the goal of the Legislature to promote the installation of 200,000 solar water heating systems in homes and businesses throughout the state by 2017.

(2) The program shall be administered by gas corporations or third-party administrators, as determined by the commission, and subject to the supervision of the commission.

(3) The commission shall coordinate the program with the Energy Commission's New Solar Homes Partnership to achieve the goal of building zero-energy homes.

(b) (1) The commission shall fund the program through the use of a surcharge applied to gas customers based upon the amount of natural gas consumed. The surcharge shall be in addition to any other charges for natural gas sold or transported for consumption in this state.

(2) The commission shall impose the surcharge at a level that is necessary to meet the goal of installing 200,000 solar water heating systems, or the equivalent output of 200,000 solar water heating systems, on homes and businesses in California by 2017. Funding for the program established by this article shall not, for the collective service territories of all gas corporations, exceed two hundred fifty million dollars ($250,000,000) over the course of the 10-year program.

(3) The commission shall annually establish a surcharge rate for each class of gas customers. Any gas customer participating in the California Alternate Rates for Energy (CARE) or Family Electric Rate Assistance (FERA) programs shall be exempt from paying any surcharge imposed to fund the program designed and implemented pursuant to this article.

(4) Any surcharge imposed to fund the program designed and implemented pursuant to this article shall not be imposed upon the portion of any gas customer's procurement of natural gas that is used or employed for a purpose that Section 896 excludes from being categorized as the consumption of natural gas.

(5) The gas corporation or other person or entity providing revenue cycle services, as defined in Section 328.1, shall be responsible for collecting the surcharge.

(c) Funds shall be allocated for the benefit of gas customers to promote utilization of solar water heating systems.

(d) In designing and implementing the program required by this article, no moneys shall be diverted from any existing programs for low-income ratepayers or cost-effective energy efficiency programs.

2864. (a) The commission, in consultation with the Energy Commission and interested members of the public, shall establish eligibility criteria for solar water heating systems receiving gas customer funded incentives pursuant to this article. The criteria should specify and include all of the following:

(1) Design, installation, and energy output or displacement standards. To be eligible for rebate funding, a residential solar water heating system shall, at a minimum, have a SRCC OG-300 Solar Water Heating System Certification. Solar collectors used in systems for multifamily residential, commercial, or industrial water heating shall, at a minimum, have a SRCC OG-100 Solar Water Heating System Certification.

(2) Require that solar water heating system components are new and unused, and have not previously been placed in service in any other location or for any other application.

(3) Require that solar water heating collectors have a warranty of not less than 10 years to protect against defects and undue degradation.

(4) Require that solar water heating systems are in buildings connected to a natural gas utility's distribution system within the state.

(5) Require that solar water heating systems have meters or other kWhth measuring devices in place to monitor and measure the system's performance and the quantity of energy generated or displaced by the system. The criteria shall require meters for systems with a capacity for displacing over 30 kWth. The criteria may require meters for systems with a capacity of 30 kWth or smaller.

(6) Require that solar water heating systems are installed in conformity with the manufacturer's specifications and all applicable codes and standards.

(b) No gas customer funded incentives shall be made for a solar water heating system that does not meet the eligibility criteria.

2865. (a) The commission shall establish conditions on gas customer funded incentives pursuant to this article. The conditions shall require both of the following:

(1) Appropriate siting and high-quality installation of the solar water heating system based on installation guidelines that maximize the performance of the system and prevent qualified systems from being inefficiently or inappropriately installed. The conditions shall not impact housing designs or densities presently authorized by a city, county, or city and county. The goal of this paragraph is to achieve efficient installation of solar water heating systems and promote the greatest energy production or displacement per gas customer dollar.

(2) Appropriate energy efficiency improvements in the new or existing home or commercial structure where the solar hot water system is installed.

(b) The commission shall set rating standards for equipment, components, and systems to ensure reasonable performance and shall develop standards that provide for compliance with the minimum ratings.

2866. (a) The commission shall provide not less than 10 percent of the overall funds for installation of solar water heating systems on low-income residential housing.

(b) The commission may establish a grant program or a revolving loan or loan guarantee program for low-income residential housing consistent with the requirements of Chapter 5.3 (commencing with Section 25425) of Division 15 of the Public Resources Code. All loans

outstanding as of August 1, 2018, shall continue to be repaid in a manner that is consistent with the terms and conditions of the program adopted and implemented by the commission pursuant to this subdivision, until repaid in full.

(c) The commission may extend eligibility for funding pursuant to this section to include residential housing occupied by ratepayers participating in a commission approved and supervised gas corporation Low-Income Energy Efficiency (LIEE) program and who either:

(1) Occupy a single-family home.

(2) Occupy at least 50 percent of all units in a multifamily dwelling structure.

(d) The commission shall ensure that lower income households, as defined in Section 50079.5 of the Health and Safety Code, and, if the commission expands the program pursuant to subdivision (c), ratepayers participating in a LIEE program, that receive gas service at residential housing with a solar water heating system receiving incentives pursuant to subdivision (a), benefit from the installation of the solar water heating systems through reduced or lowered energy costs.

(e) No later than January 1, 2010, the commission shall do all of the following to implement the requirements of this section:

(1) Maximize incentives to properties that are committed to continuously serving the needs of lower income households, as defined in Section 50079.5 of the Health and Safety Code, and, if the commission expands the program pursuant to subdivision (c), ratepayers participating in a LIEE program.

(2) Establish conditions on the installation of solar water heating systems that ensure properties on which solar water heating systems are installed under subdivision (a) remain low-income residential properties for at least 10 years from the time of installation, including property ownership restrictions and income rental protections, and appropriate enforcement of these conditions.

(f) All moneys set aside for the purpose of funding the installation of solar water heating systems on low-income residential housing that are unexpended and unencumbered on August 1, 2018, and all moneys thereafter repaid pursuant to subdivision (b), except to the extent that those moneys are encumbered pursuant to this section, shall be utilized to augment cost-effective energy efficiency measures in low-income residential housing that benefit ratepayers.

2867. (a) The rebates provided through this program shall decline over time. They shall be structured so as to drive down the cost of the solar water heating technologies, and be paid out on a performance-based incentive basis so that incentives are earned based on the actual energy savings, or on predicted energy savings as established by the commission.

(b) The commission shall consider federal tax credits and other incentives available for this technology when determining the appropriate rebate amount.

(c) The commission shall consider the impact of rebates for solar water heating systems pursuant to this article on existing incentive programs for energy efficiency technology.

(d) In coordination with the commission, the Energy Commission shall consider, when appropriate, coupling rebates for solar water heating systems with complementary energy efficiency technologies, including, but not limited to, efficient hot water heating tanks and tankless or on demand hot water systems that can be installed in addition to the solar water heating system.

2867.1. Not later than July 1, 2010, the commission shall report

to the Legislature as to the effectiveness of the program and make recommendations as to any changes that should be made to the program. This report shall include justification for the size of the rebate program in terms of total available incentive moneys as well as the anticipated benefits of the program in its entirety. To facilitate the understanding of how solar water heating systems compare with other clean energy and energy efficiency technologies, all documents related to and rebates provided by this program shall be measured in both kWhth and therms of natural gas saved.

2867.2. Except for the Solar Water Heating Pilot Program in San Diego, solar water heating technologies shall not be eligible for California Solar Initiative (CSI) funds, pursuant to Section 2851, unless they also displace electricity, in which case only the electricity displacing portion of the technology may be eligible under the CSI program, as determined by the commission.

2867.3. In order to further the state goal of encouraging the installation of 200,000 solar water heaters by 2017, the governing body of each publicly owned utility providing gas service to retail end-use gas customers shall, after a public proceeding, adopt, implement, and finance a solar water heating system incentive program that does all the following:

(a) Ensures that any solar water heating system receiving monetary incentives complies with eligibility criteria adopted by the governing body. The eligibility criteria shall include those elements contained in paragraphs (1) to (6), inclusive, of subdivision (a) of Section 2864.

(b) Includes minimum ratings and standards for equipment, components, and systems to ensure reasonable performance and compliance with the minimum ratings and standards.

(c) Includes an element that addresses the installation of solar water heating systems on low-income residential housing. If deemed appropriate in consultation with the California Tax Credit Allocation Committee, the governing board may establish a grant program or a revolving loan or loan guarantee program for low-income residential housing consistent with the requirements of Chapter 5.3 (commencing with Section 25425) of Division 15 of the Public Resources Code.

2867.4. This article shall remain in effect only until August 1, 2018, and as of that date is repealed, unless a later enacted statute, that is enacted before August 1, 2018, deletes or extends that date.

SEC. 3. No reimbursement is required by this act pursuant to Section 6 of Article XIII B of the California Constitution because a local agency or school district has the authority to levy service charges, fees, or assessments sufficient to pay for the program or level of service mandated by this act, within the meaning of Section 17556 of the Government Code.